# CHAPTER 4

# DATA ANALYSIS AND INTERPRETATION

## 4.0 Introduction

This chapter presents the analyses and interpretation of data generated from the research through different tools used at various stages of the study. The research questions for the study are reiterated in the form of the hypotheses. Quantitative results from the data collected by means of the tests are examined through different statistical procedures. The data collected from the pre-test and post-test scores shall be used to accept or reject the hypotheses set out in the study. In addition to the quantitative analysis and interpretation of the data, a descriptive and qualitative analysis is presented with the results of the online questionnaire that was administered to students after completion of the technology-enabled language enhancement writing program for purposes of program evaluation.

## 4.1 Hypotheses

The purpose of this study was to establish the effectiveness of the technology-enabled language enhancement program for the written communication skills of 'English as a Second language' (ESL) learners at tertiary level. The following null hypotheses guided the study:

i.   There will be no significant difference between the **mean scores on the pre-test and post-test** of the students who underwent the technology-enabled language enhancement program to develop written communication skills.

ii.  There will be no significant differences **among the mean scores** on the pre-tests and post-tests of the students who underwent the technology-enabled language enhancement program to develop written communication skills in the **various components of written communication skills**.

## 4.2 Demographic details

The present study adopted the one group pre-test post-test design experimental research design to test the hypotheses posed in the study. The participants used the in the study belonged to an intact group. The

participants constituted first-year university students who took the common English course, English for Communication II in the second term of the academic year at Lingnan University in Hong Kong, as a required course on their degree programs. A total of 41 students participated in the study.

Demographic information was collected from students in order to obtain an accurate description of participants for the study. Items collecting demographic details included program major, year of study, gender, age, place of origin, and mother tongue. According to the demographic information collected, 26 students (63.40%) Business Administration (BBA) majors and 15 students (36.60%) were Non-BBA majors from the Arts or Social Sciences streams which included Chinese, History, Philosophy, Cultural Studies, and Visual Studies, 32 students (78.04%) were from Year 1, 5 (12.19%) from Year 2, and 4 (9.75%) from Year 3, 21 (51.20%) were female and 20 (48.80%) were male, whereas 31 students (75.60%) mentioned Hong Kong as their place of birth and 10 (24.39%) students noted their place of birth as Mainland China, 36 students (87.80%) were native Cantonese speakers and 5 (12.19%) students were native speakers of Putonghua (Mandarin or Chinese).

Table 4.1 shows the demographic details of the students who participated in the experiment.

**Table 4.1** Demographic details of participants

| Variables | | Number | Percentage |
|---|---|---|---|
| Year of Study | Year 1 | 32 | 78.04 % |
| | Year 2 | 5 | 12.19 % |
| | Year 3 | 4 | 9.75 % |
| Total | | 41 | 100% |
| **Degree Program Major \*** | **BBA** | **26** | **63.40 %** |
| | **Non-BBA** | **15** | **36.60 %** |
| Total | | 41 | 100% |
| **Gender \*** | **Male** | **20** | **48.80 %** |
| | **Female** | **21** | **51.20 %** |
| Total | | 41 | 100% |
| Country of Origin | Hong Kong ( China ) | 31 | 75.60 % |
| | China | 10 | 24.39 % |
| Total | | 41 | 100% |
| Mother Tongue | Cantonese | 36 | 87.80 % |
| | Putonghua (Chinese) | 5 | 12.19 % |
| Total | | 41 | 100% |

*\* - Indicates Non–homogeneous variables*

The demographic information collected revealed that with respect to age, year of study, socio-linguistic and educational background, the sample for the study was essentially homogenous. Consequently, only two major variables that is, gender and degree program were used in the study for further data analysis and interpretation. Thus, a detailed analyses of the study shall also be carried out with respect to the two variables namely, gender and degree program major.

Figure 4.1 gives a graphical representation of the gender distribution of the sample used in the study.

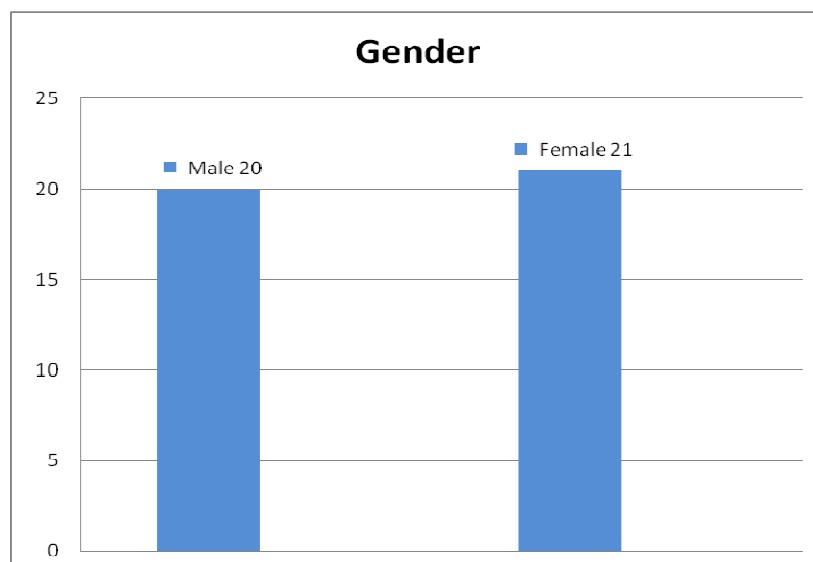**Figure 4.1** Gender Distribution Graph

Table 4.2 presents details on the gender distribution among the sample for the study.

**Table 4.2** Gender Distribution

|  | **Number** | **Percent** |
|---|---|---|
| **Male** | 20 | 48.80% |
| **Female** | 21 | 51.20% |
| **Total** | 41 | 100.00 |

The above data shows that out of a total of 41 students who took the pre-test and post-test, 20 were males and 21 were females.

Figure 4.2 gives a graphical representation of the distribution of the degree program major of the participants in the study.
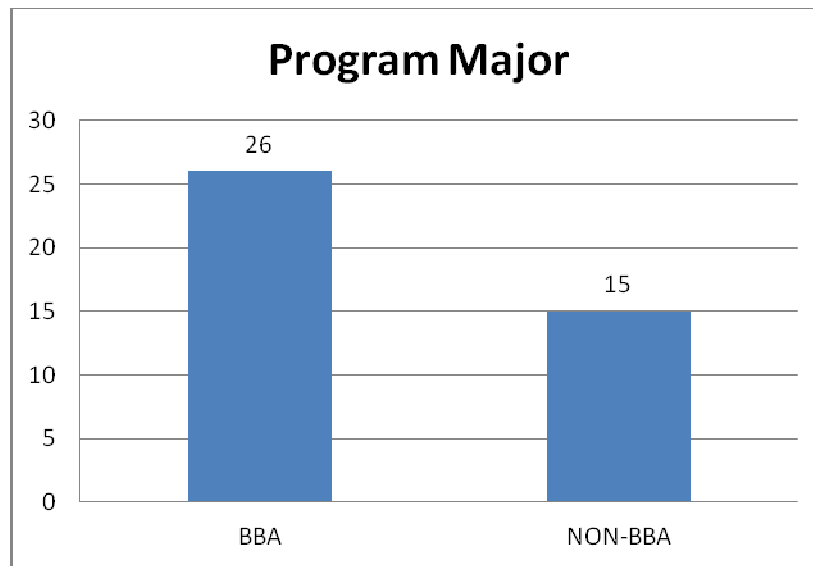
**Figure 4.2** Degree program major distribution graph



Table 4.3 gives details on the degree program major of the participants for the study.

**Table 4.3** Degree Program Major

|  | **Number** | **Percent** |
| --- | --- | --- |
| **BBA** | 26 | 63.40 % |
| **Non-BBA** | 15 | 36.60 % |
| **Total** | 41 | 100 % |

The above data shows that out of a total of 41 students who took the pre and post tests, 26 were to BBA majors whereas 15 were Arts and Social Sciences (Non-BBA) majors.

## 4.3 Pre-Test and post-test scores

In accordance with the requirement of the study, one-group pre-test, post-test research design was adopted as explained in Section 3.3. On one hand, the pre-test was administered at the beginning of the experiment as a regulatory means to control prior differences among participants. On the other hand, the post-test was administered towards the end of the experiment to measure the effectiveness of the treatment, that is, the technology-enabled language enhancement program. The statistical procedures of T-test and ANOVA were used to evaluate the effectiveness of the treatment offered to the participants as part of the experiment.

## 4.3.1 Descriptive analysis for overall pre-test and post-test scores

Before moving on to the comparing of means, which is an inferential statistical procedure, the data collected from the test scores were analysed with the aid of descriptive statistics. As noted by Sheligar and Shohamy (1989), descriptive statistics refers to a set of procedures which are used to *describe* different aspects of the data. While such information can sometimes be the sole purpose of the research, at other times, it may provide the researcher with basic insights and an initial impression of the data or the information that will be useful for subsequent analysis phases of the

research. The major types of descriptive statistics used for various analysis includes, central tendencies, variabilities, and at times, correlations.

C*entral tendency measures* provide information about the average and typical behaviour of subjects with respect to a specific phenomenon. The mean is the central tendency measure which is most frequently used because of its stability in repeated sampling and its use in advance statistical procedures (Sheligar and Shohamy, 1989).

In addition, while *central tendencies* provide information on the *average* behaviour of the subjects on certain tasks, *variability* provides information on the spread of the behaviours of the phenomena among the subjects of the research. The most common variability measure used for subsequent analysis of research data is the *standard deviation* (S.D.). The value computed as a result of the standard deviation reveals how varied and heterogeneous a group is on a given behaviour, and whether the behaviour is distributed more widely within the group.

Thus, for the present study, the data collected from the pre-test and post-test scores was first computed for a descriptive statistical analysis before any subsequent analysis. Details collected from the test scores revealed that the overall mean of the pre-test was 34.07 and the standard deviation was 7.05.

The overall mean of the post-test was 39.42 and the standard deviation was 5.07. Descriptive details of the pre-test and post-test scores are provided in Table 4.4

**Table 4.4** Paired samples statistics for overall test scores

|  | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Overall Post-Test Score | 39.42 | 41 | 5.07 | 0.79 |
| Overall Pre-Test Score | 34.07 | 41 | 7.05 | 1.10 |

In addition, to the analysis of the pre-test and post-tests scores with respect to the means and standard deviation, a correlation analysis of the pre-tests and post-tests was also conducted. Details on correlation analysis of the pre-test and post-test scores are provided in Table 4.5.

**Table 4.5** Correlation analysis of pre-test and post-test scores

|  | N | Correlation | Sig. |
|---|---|---|---|
| Overall Post Test Score & Overall Pre Test Score | 41.000 | 0.548 | 0.000 |

The details of the correlation analysis revealed a significant value of correlation of 0.548 (which lies between 0 and 1) with a significance of 0.000. This showed that the overall scores of the pre-test and post-test were highly correlated.

## 4.3.2 T-test analysis

On the basis of the analysis obtained through descriptive statistics, further analysis of the scores for the pre-test and post-test was done by means of the T-test. Sheligar and Shohamy (1989) point out that "the T-test is used to compare the means of two groups."(p. 231). For the present study, the T-test was used to the compare the means of the pre-test and the post-test. In other words, the T-test was used to compare the two groups of test scores. Sheligar and Shohamy (1989) further describe the value of the T-test by stating that the T-test helps determine how confident the researcher can be that the differences found between two groups as a result of a treatment are not due to chance. The results of applying the T-test provide the researcher

with a T-value. The T-value indicates whether, given size of the sample in the research, the T-value is statistically significant. For the current study, the T-test analysis was conducted for the first hypothesis set out in the study.

**a) Hypothesis one: differences in mean scores**

There will be no significant difference between the **mean scores on the pre-test and post-test** of the students who underwent the technology-enabled language enhancement program to develop written communication skills.

A T-test analysis was carried out to obtain details of overall differences in the pre-test and post-test scores for the students who underwent the technology-enabled language enhancement program to develop written communication skills. Details obtained from the T-test analysis of the pre-test and post-test are shown in the Table 4.6.

**Table 4.6** Paired T-test for overall score

| Paired Differences | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| Overall Post-Test Score – Pre-Test Score | | | | Lower | Upper | T | df | Sig. (2-tailed) |
| | 5.35366 | 6.02001 | 0.94017 | 3.45351 | 7.25381 | 5.694 | 40 | 0.000 |

The T-value obtained from the analysis of the overall mean scores of the pre-test and the post-test was 5.694. The details of the paired T-test analysis for the pre-test and post-test scores also revealed that the P-value or value of significance was 0.000, at the level of 0.05. This meant that there was a significant difference between the overall mean scores of the pre-test and post-test at 5% level of significance. The mean of the paired difference was 5.35366 which suggested that the overall average score of the post-test was high compared to the pre-test score. Thus, the findings could determine that the significant differences found in the overall means scores of the pre-test and the post-test were not due to chance but due to the treatment, that is, due to the technology-enabled language enhancement program. As a result, the analysis obtained could be useful in rejecting the first null hypothesis of the study.

Consequently, the first finding from the analysis could establish that **there is a significant difference** between the **overall mean scores on the pre-test and post-test** of the students who underwent the technology-enabled language enhancement program to develop written communication skills.

## b) Difference in mean scores in relation to gender

In order to investigate further differences in relation to gender, an analysis was carried out to find out if the technology-enabled program had any significant difference among male participants and female participants. The data collected from the pre-test and post-test scores was first computed for a descriptive statistics analysis before the T-test analysis in relation to gender. Table 4.7 provides details of the difference in means scores of the pre-test and post-test scores in relation to gender.

**Table 4.7** Details of pre-test and post-test scores in relation to gender

| Gender | N | Mean | Std. Deviation | Std. Error Mean |
|--------|-----|------|----------------|-----------------|
| **Male** | 20 | 5.65 | 7.51 | 1.68 |
| **Female** | 21 | 5.07 | 4.33 | 0.94 |

Details collected from the test scores revealed that the difference in the means score of the pre-test and post-test for males was 5.65 and the standard deviation was 7.51. On the other hand, the difference in the means score of the pre-test and post-test for females was 5.07 and the standard deviation was 4.33.

After descriptive details were obtained for the pre-test and post-test with respect to gender, a T-test analysis was carried out to obtain details of differences in the pre-test and post-test scores for the students who underwent the technology-enabled language enhancement program to develop written communication skills in relation to gender. Details obtained from the T-test analysis of the pre-test and post-test in relation to gender are shown in the Table 4.8.

**Table 4.8** Differences in pre-test and post-test scores with respect to gender

| | Levene's Test for Equality of Variances | | T-test for Equality of Means | | | | | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|---|---|
| | F | Sig. | T | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Upper | Lower |
| Equal variances assumed | 5.699 | 0.022 | 0.304 | 39 | 0.763 | 0.57857 | 1.9026 | -3.26981 | 4.42695 |
| Equal variances not assumed | | | 0.3 | 30.072 | 0.766 | 0.57857 | 1.92661 | -3.35569 | 4.51283 |

An analysis of pre-test and post-test scores in relation to gender showed that the P-value or the significance value corresponding to the F-test of equal variances assumed is 0.022 which is less than 0.05. This suggested that the independent two sample T-test with unequal variance should be used to

compare the mean scores of the pre-test and the post-test with respect to gender. The P-value of t-test with unequal variance was 0.766, which was greater than 0.05. This meant that there was no significance difference in mean score of pre-test and post-test with respect to gender at 5% level of significance. As a result, the finding suggested that since there was no significant difference to be found in the mean scores of the pre-test and the post-test with respect to gender. It could be concluded that the technology-enabled language enhancement program had equal effect on males as well as females.

**c) Difference in mean scores in relation to program major**

In order to obtain further differences in relation to degree program major, an analysis was carried out to find out if the technology-enabled program had any significant difference among BBA participants and non-BBA participants. The data collected from the pre-test and post-test scores was first computed for a descriptive statistics analysis before the T-test analysis in relation to degree program major. Table 4.9 provides details of the difference in means scores of the pre-test and post-test scores in relation to degree program major.

**Table 4.9** Details of pre-test and post-test scores in relation to degree program major

| Program Major | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| BBA | 26 | 4.50 | 5.39 | 1.06 |
| Non-BBA | 15 | 6.83 | 6.93 | 1.79 |

Details collected from the test scores revealed that the difference in the means score of the pre-test and post-test for BBA majors was 4.50 and the standard deviation was 5.39. On the other hand, the difference in the means

score of the pre-test and post-test for non-BBA was 6.83 and the standard deviation was 6.93.

After descriptive details were obtained for the pre-test and post-test with respect to degree program major, a T-test analysis was carried out to obtain details of differences in the pre-test and post-test scores for the students who underwent the technology-enabled language enhancement program to develop written communication skills in relation to degree program major. Details obtained from the T-test analysis of the pre-test and post-test in relation to degree program major are shown in the Table 4.10.

**Table 4.10** Differences in pre-test and post-test scores with respect to degree program major

| | Levene's Test for Equality of Variances | | T-test for Equality of Means | | | | | 95% Confidence Interval of the Difference | |
| | F | Sig. | T | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | | |
| | | | | | | | | Upper | Lower |
| Equal variances assumed | 0.297 | 0.589 | -1.202 | 39 | 0.237 | -2.33333 | 1.94113 | -6.25964 | 1.59298 |
| Equal variances not assumed | | | -1.123 | 23.85 | 0.273 | -2.33333 | 2.07763 | -6.62277 | 1.9561 |

An analysis of pre-test and post-test scores in relation to degree program major showed that the P-value or the significance value corresponding to the F-test of equal variances assumed is 0.589 which is greater than 0.05. This suggested that there was no significance difference in mean score of pre-test and post-test with respect to degree program major at 5% level of significance. As a result, the finding suggested that since there was no significant difference to be found in the mean scores of the pre-test and the post-test with respect to degree program major. It could be concluded that the technology-enabled language enhancement program had equal effect on BBA majors as well as Non-BBA majors.

### 4.3.3 Descriptive analysis of various components of the pre-test and post-test

In addition to the descriptive analysis of the scores for the pre-test and post-test for the present study, a descriptive analysis of the various components of the tests was also carried out. The data collected from this analysis would be used for subsequent analysis of the obtained scores for various components of the tests. There six major components of tests included *logical arrangement of sentences*, *grammar and error correction*, *unity and cohesion*, *reading comprehension and vocabulary*, *summary writing*, and *paragraph writing*. Details collected for the analysis included descriptive statistics on the differences in the overall mean scores of the various components of the pre-test and post-test. Table 4.11 provides details of the differences in the overall means scores of various components of the pre-test and post-test scores.

**Table 4.11** Differences among Overall Mean Scores of Various Test

Components

| | N | Mean | Std. Dev. | Std. Error | 95% Confidence Interval for Mean | | Min | Max |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| **Logical arrangement of sentences** | 41 | 1.60 | 2.80 | 0.44 | 0.71 | 2.48 | -6.25 | 7.5 |
| **Grammar and Error Correction** | 41 | 0.44 | 1.99 | 0.31 | -0.19 | 1.07 | -3 | 4 |
| **Unity and cohesion** | 41 | 1.95 | 2.01 | 0.31 | 1.32 | 2.59 | -2 | 8 |
| **Vocabulary** | 41 | -0.34 | 3.79 | 0.59 | -1.54 | 0.86 | -6 | 10 |
| **Summary Writing** | 41 | 0.48 | 2.40 | 0.38 | -0.28 | 1.23 | -5 | 9 |
| **Paragraph Writing** | 41 | 1.23 | 1.58 | 0.25 | 0.73 | 1.73 | -0.5 | 7 |

The details show that the highest difference in the overall mean values could be noted in the *unity and cohesion* component which was 1.95, followed by the *logical arrangement of sentences* component which was 1.60. This suggested that there had been an overall improvement more in the *unity and cohesion* component followed by the *logical arrangement of sentences* component compared to the other components of the tests.

Details collected for the analysis also included descriptive statistics on the differences in the mean scores of the various components of the pre-test and post-test in relation to gender.

Table 4.12 provides details of the differences in the means scores of various components of the pre-test and post-test scores in relation to gender.

**Table 4.12** Differences among mean scores of various test components in relation to gender

| Gender | Component | N | Mean | Std. Dev | Std. Error | 95% Confidence Interval for Mean | | Min | Max |
|--------|-----------|---|------|----------|------------|-------------|-------------|-----|-----|
| | | | | | | Lower Bound | Upper Bound | | |
| **Male** | Logical arrangement of sentences | 20 | 2.33 | 2.53 | 0.57 | 1.14 | 3.51 | -1.25 | 7.50 |
| | Grammar and Error Correction | 20 | 0.65 | 2.30 | 0.51 | -0.43 | 1.73 | -3.00 | 4.00 |
| | Unity and cohesion | 20 | 1.25 | 2.31 | 0.52 | 0.17 | 2.33 | -2.00 | 8.00 |
| | Vocabulary | 20 | -0.60 | 3.73 | 0.83 | -2.35 | 1.15 | -6.00 | 10.00 |
| | Summary Writing | 20 | 0.53 | 2.72 | 0.61 | -0.75 | 1.80 | -4.00 | 9.00 |
| | Paragraph Writing | 20 | 1.50 | 2.09 | 0.47 | 0.52 | 2.48 | -0.50 | 7.00 |
| | Total | 120 | 0.94 | 2.77 | 0.25 | 0.44 | 1.44 | -6.00 | 10.00 |
| **Female** | Logical arrangement of sentences | 21 | 0.90 | 2.93 | 0.64 | -0.43 | 2.24 | -6.25 | 6.25 |
| | Grammar and Error Correction | 21 | 0.24 | 1.67 | 0.36 | -0.52 | 1.00 | -3.00 | 3.00 |
| | Unity and cohesion | 21 | 2.62 | 1.43 | 0.31 | 1.97 | 3.27 | 0.00 | 6.00 |
| | Vocabulary | 21 | -0.10 | 3.92 | 0.86 | -1.88 | 1.69 | -6.00 | 8.00 |
| | Summary Writing | 21 | 0.43 | 2.12 | 0.46 | -0.54 | 1.39 | -5.00 | 3.00 |
| | Paragraph Writing | 21 | 0.98 | 0.83 | 0.18 | 0.60 | 1.35 | 0.00 | 3.00 |
| | Total | 126 | 0.85 | 2.49 | 0.22 | 0.41 | 1.28 | -6.25 | 8.00 |

The details presented in the table showed that the highest difference in the mean scores obtained by males could be seen in the *logical arrangement of sentences* component which was 2.33 followed by *paragraph writing* component which was 1.50. On the other hand, the highest difference in mean scores obtained by females could be seen in the *unity and cohesion*

component which is 2.62 followed by *paragraph writing* component which is 0.98.

This suggested that while scores for males improved in the *logical arrangement of sentences* component, the scores for females improved in the *unity and cohesion* component compared to other components. However, the second best improvement of scores could be seen in both males and females in the *paragraph writing* component.

Details collected for the analysis also included descriptive statistics on the differences in the mean scores of the various components of the pre-test and post-test in relation to degree program major. Table 4.13 provides details of the differences in the means scores of various components of the pre-test and post-test scores in relation to degree program major.

**Table 4.13** Differences among mean scores of various test components in relation to degree program major

| Program Major | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Min | Max |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound | | |
| BBA | Logical arrangement of sentences | 26 | 1.60 | 3.19 | 0.63 | 0.31 | 2.88 | -6.25 | 7.5 |
| | Grammar and Error Correction | 26 | 0.54 | 2.06 | 0.40 | -0.30 | 1.37 | -3 | 4 |
| | Unity and cohesion | 26 | 1.85 | 1.95 | 0.38 | 1.06 | 2.64 | -1 | 8 |
| | Vocabulary | 26 | -0.62 | 3.29 | 0.64 | -1.94 | 0.71 | -6 | 8 |
| | Summary Writing | 26 | -0.02 | 2.17 | 0.43 | -0.90 | 0.86 | -5 | 3 |
| | Paragraph Writing | 26 | 1.15 | 1.39 | 0.27 | 0.59 | 1.72 | 0 | 7 |
| | Total | 156 | 0.75 | 2.56 | 0.20 | 0.35 | 1.15 | -6.25 | 8 |
| NON-BBA | Logical arrangement of sentences | 15 | 1.60 | 2.06 | 0.53 | 0.46 | 2.74 | -1.25 | 5 |
| | Grammar and Error Correction | 15 | 0.27 | 1.91 | 0.49 | -0.79 | 1.32 | -3 | 3 |
| | Unity and cohesion | 15 | 2.13 | 2.17 | 0.56 | 0.93 | 3.33 | -2 | 6 |
| | Vocabulary | 15 | 0.13 | 4.63 | 1.19 | -2.43 | 2.70 | -6 | 10 |
| | Summary Writing | 15 | 1.33 | 2.61 | 0.67 | -0.11 | 2.78 | -1.5 | 9 |
| | Paragraph Writing | 15 | 1.37 | 1.90 | 0.49 | 0.31 | 2.42 | -0.5 | 7 |
| | Total | 90 | 1.14 | 2.74 | 0.29 | 0.57 | 1.71 | -6 | 10 |

The details presented in the table showed that the highest difference in the mean scores could be seen in the *unity and cohesion* component which was 1.85 followed by *logical arrangement of sentences* which is 1.60 for BBA majors. Similarly, the highest difference in mean values could be seen in the *unity and cohesion* component which is 2.13 followed by *logical arrangement of sentences* which is 1.60 for Non-BBA majors.

This suggested that both BBA as well as Non-BBA majors had improved scores in the *unity and cohesion* component followed by the *logical arrangement of sentences* component compared to the other components.

## 4.3.4 ANOVA

On the basis of the analysis obtained through descriptive statistics, further analysis of the overall scores for the pre-test and post-test was done by means of and analysis of variance (ANOVA). While the T-test compares two sets of data, ANOVA is used to compare more than two sets.

For the present study, an ANOVA was carried out for the comparing the overall mean scores of the various components of the pre-test and the post-test. Sheligar and Shohamy (1989) describe the value of the ANOVA by stating that the ANOVA helps determine how confident the researcher can be that the differences observed among various sets of data are a result of the treatment are not due to chance. The analysis is performed on the *variance* of the sets of data, focusing on whether the variability *between* the different sets of data is greater than the variability *within* each of the groups. The results of applying the ANOVA provide the researcher with an F-value. The F-value is the ratio of the 'between' variance over the 'within' variance.

The statistical significance of the F-value depends on the variability among the data sets and the variability within each data set. For the current study, the ANOVA analysis was conducted for the remaining three hypothesis set out in the study.

**a) Hypothesis two: difference among mean scores of various components**

There will be no significant differences **among the mean scores** on the pre-tests and post-tests of the students who underwent the technology-enabled language enhancement program to develop written communication skills in the **various components of written communication skills**.

The ANOVA was carried out to obtain details of overall differences among various components of the pre-test and post-test scores for the students who underwent the technology-enabled language enhancement program to develop written communication skills. Details obtained from the ANOVA of the various components of the pre-test and post-test are shown in the Table 4.14.

**Table 4.14** ANOVA for various test components

|                    | Sum of Squares | Df  | Mean Square | F     | Sig.  |
|--------------------|----------------|-----|-------------|-------|-------|
| **Between Groups** | 149.042        | 5   | 29.808      | 4.647 | 0.000 |
| **Within Groups**  | 1,539.35       | 240 | 6.414       |       |       |
| **Total**          | 1,688.40       | 245 |             |       |       |

The F-value obtained from the analysis of the overall mean scores of the pre-test and the post-test was 4.647. The details of the ANOVA for the various components of the pre-test and post-test scores also revealed that the P-value or value of significance was 0.000, at the level of 0.05. This meant that there was a significant difference among overall means scores of various components of the pre-test and post-test at 5% level of significance. Thus, the findings could determine that the significant differences found in the overall means scores for various components of the pre-test and the post-test were not due to chance but due to the treatment, that is, due to the technology-enabled language enhancement program. As a result, the analysis obtained could be useful in rejecting the fourth null hypothesis of the study.

Consequently, the second finding from the analysis could establish that **there were significant differences among the mean scores** on the pre-tests and post-tests of the students who underwent the technology-enabled language enhancement program to develop written communication skills in the **various components of written communication skills**.

**b) Difference among mean scores in relation to gender**

The ANOVA was carried out to obtain details of differences among various components of the pre-test and post-test scores for the students who underwent the technology-enabled language enhancement program to develop written communication skills in relation to gender. Details obtained from the ANOVA of the various components of the pre-test and post-test in relation to gender are shown in the Table 4.15.

**Table 4.15** ANOVA in relation to gender

| Gender | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Male** | Between Groups | 99 | 5 | 19.823 | 2.781 | 0.021 |
| | Within Groups | 812 | 114 | 7.127 | | |
| | Total | 912 | 119 | | | |
| **Female** | Between Groups | 96.47 | 5 | 19.294 | 3.406 | 0.007 |
| | Within Groups | 679.762 | 120 | 5.665 | | |
| | Total | 776.232 | 125 | | | |

The F-value obtained from the analysis of the mean scores of the pre-test and the post-test for males was 2.781 and for females was 3.406. The details of the ANOVA for the various components of the pre-test and post-test scores in relation to gender also revealed that the P-value or value of significance for males was 0.021 and for females was 0.007, at the level of 0.05. This meant that there was a significant difference among means scores

of various components of the pre-test and post-test in relation to gender at 5% level of significance. Thus, since the P-value for both males and females was less than 0.05, the findings could determine that the significant differences found in the means scores for various components of the pre-test and the post-test in relation to gender were not due to chance but due to the treatment, that is, due to the technology-enabled language enhancement program.

## c) Difference among mean scores in relation to program major

The ANOVA was carried out to obtain details of differences among various components of the pre-test and post-test scores for the students who underwent the technology-enabled language enhancement program to develop written communication skills in relation to degree program major. Details obtained from the ANOVA of the various components of the pre-test and post-test in relation to degree program major are shown in the Table 4.16.

**Table 4.16** ANOVA in relation to degree program major

| Program | | Sum of Squares | df | Mean Square | F | Sig. |
|---------|---|----------------|-----|-------------|-----|------|
| **BBA** | Between Groups | 119.115 | 5 | 23.823 | 4.003 | 0.002 |
| | Within Groups | 892.76 | 150 | 5.952 | | |
| | Total | 1011.875 | 155 | | | |
| **NON-BBA** | Between Groups | 45.947 | 5 | 9.189 | 1.241 | 0.297 |
| | Within Groups | 621.942 | 84 | 7.404 | | |
| | Total | 667.889 | 89 | | | |

Looking at the table of ANOVA we can see P-value for BBA majors is 0.002 (<0.05) and the P-value for Non-BBA majors is 0.297(>0.05). This suggests that the mean scores significantly differ on various components in the pre and post tests in relation to program major for BBA students whereas

the mean scores do not significantly differ on various components in the pre and post tests in relation to program major for Non-BBA students.

The F-value obtained from the analysis of the mean scores of the pre-test and the post-test for BBA majors was 4.003 and for non-BBA majors was 1.241. The details of the ANOVA for the various components of the pre-test and post-test scores in relation to degree program major also revealed that the P-value or value of significance for BBA majors was 0.002 and for non-BBA majors was 0.297, at the level of 0.05. This meant that there was a significant difference among means scores of various components of the pre-test and post-test for BBA majors at 5% level of significance. However, there was no significant difference among means scores of various components of the pre-test and post-test for non-BBA majors at 5% level of significance. Thus, since the P-value for BBA majors was less than 0.05, the findings could determine that the significant differences found in the means scores for various components of the pre-test and the post-test for the BBA majors were not due to chance but due to the treatment, that is, due to the technology-enabled language enhancement program. On the other hand, since the P-value for non-BBA majors was more than 0.05, the findings could determine that there was no significant differences found in the means scores for various components of the pre-test and the post-test for the non-BBA majors.

### 4.4.5 Post-hoc tests

When the obtained F-value from the ANOVA is significant, that is when the null hypothesis of no difference is rejected, there lies a need for the researcher to find out *where* the differences are, that is, between which of the data sets. The researcher therefore needs to compare the pairs of data sets using certain procedures which are capable of examining two data sets at a time.

These statistical procedures are called post-hoc tests. For the present study while the F-value obtained through ANOVA for the fourth and fifth hypothesis was significant, various post-hoc tests were carried to find out *where* the differences were in the various data sets. In order to decide the type of the post-hoc tests to be used for further analysis, a test for homogeneity of variances is conducted. The value obtained from this test is useful in deciding the type of the post-hoc test to be determined for detailed analysis of finding out in which pair of data sets the differences remain.

**a) Post-hoc analysis for hypothesis two**

While the second finding from the analysis could establish that **there were significant differences among the overall mean scores** of the students who underwent the technology-enabled language enhancement program to develop written communication skills **of the various components of written communication skills** in pre-test and post test, a test for homogeneity of variances was carried out for a further post-hoc analysis to determine the data sets among which the differences lied. Details of the test of homogeneity of variances have been provided in Table 4.17

**Table 4.17** Test of Homogeneity of Variances for overall scores

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| 6.605 | 5 | 240 | 0.000 |

The details of the test of homogeneity of variances presented that the P-value or value of significance is 0.000 which is less than 0.01. This suggested that the equal variance assumptions between components did not hold. Therefore, at the time of multiple comparisons of various components the researcher decided to use the Tamhane Test. Details of the multiple comparisons through the post-hoc Tamhane test for overall scores of the pre-test and post-test are presented in Table 4.18.

**Table 4.18** Multiple comparisons through post-hoc tests for overall scores

| (I) Components | (J) Components | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| Tamhane | | | | | | |
| | | | | | Upper Bound | Lower Bound |
| Logical arrangement of sentences | Grammar and Error Correction | 1.15854 | 0.53631 | 0.406 | -0.4654 | 2.7824 |
| | Unity and cohesion | -0.35366 | 0.53847 | 1 | -1.9838 | 1.2764 |
| | Vocabulary | 1.93902 | 0.73619 | 0.144 | -0.2886 | 4.1666 |
| | Summary Writing | 1.12195 | 0.57625 | 0.573 | -0.6183 | 2.8622 |
| | Paragraph Writing | 0.36585 | 0.50192 | 1 | -1.1614 | 1.8931 |
| Grammar and Error Correction | Logical arrangement of sentences | -1.15854 | 0.53631 | 0.406 | -2.7824 | 0.4654 |
| | Unity and cohesion | -1.51220(*) | 0.44173 | 0.015 | -2.8453 | -0.1791 |
| | Vocabulary | 0.78049 | 0.66869 | 0.986 | -1.2577 | 2.8187 |
| | Summary Writing | -0.03659 | 0.48707 | 1 | -1.5081 | 1.4349 |
| | Paragraph Writing | -0.79268 | 0.39636 | 0.53 | -1.9907 | 0.4054 |
| Unity and cohesion | Logical arrangement of sentences | 0.35366 | 0.53847 | 1 | -1.2764 | 1.9838 |
| | Grammar and Error Correction | 1.51220(*) | 0.44173 | 0.015 | 0.1791 | 2.8453 |
| | Vocabulary | 2.29268(*) | 0.67042 | 0.017 | 0.2498 | 4.3356 |
| | Summary Writing | 1.47561 | 0.48945 | 0.051 | -0.0029 | 2.9541 |
| | Paragraph Writing | 0.71951 | 0.39928 | 0.692 | -0.4875 | 1.9266 |
| Vocabulary | Logical arrangement of sentences | -1.93902 | 0.73619 | 0.144 | -4.1666 | 0.2886 |
| | Grammar and Error Correction | -0.78049 | 0.66869 | 0.986 | -2.8187 | 1.2577 |
| | Unity and cohesion | -2.29268(*) | 0.67042 | 0.017 | -4.3356 | -0.2498 |
| | Summary Writing | -0.81707 | 0.70113 | 0.986 | -2.9449 | 1.3107 |
| | Paragraph Writing | -1.57317 | 0.64144 | 0.232 | -3.5389 | 0.3925 |
| Summary Writing | Logical arrangement of sentences | -1.12195 | 0.57625 | 0.573 | -2.8622 | 0.6183 |
| | Grammar and Error Correction | 0.03659 | 0.48707 | 1 | -1.4349 | 1.5081 |
| | Unity and cohesion | -1.47561 | 0.48945 | 0.051 | -2.9541 | 0.0029 |
| | Vocabulary | 0.81707 | 0.70113 | 0.986 | -1.3107 | 2.9449 |
| | Paragraph Writing | -0.7561 | 0.44893 | 0.782 | -2.1175 | 0.6053 |
| Paragraph Writing | Logical arrangement of sentences | -0.36585 | 0.50192 | 1 | -1.8931 | 1.1614 |
| | Grammar and Error Correction | 0.79268 | 0.39636 | 0.53 | -0.4054 | 1.9907 |
| | Unity and cohesion | -0.71951 | 0.39928 | 0.692 | -1.9266 | 0.4875 |
| | Vocabulary | 1.57317 | 0.64144 | 0.232 | -0.3925 | 3.5389 |
| | Summary Writing | 0.7561 | 0.44893 | 0.782 | -0.6053 | 2.1175 |

* The mean difference is significant at 5% level

The details presented in the Tamhane table revealed that the P-value between the *unity and cohesion* component and *grammar and error correction* component was 0.015 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and *grammar and error correction* component significantly differ at the 5% level of significance. The difference of the mean value of the two components is 1.51220 which suggested that the *unity and cohesion* component had a higher mean score compared to the *grammar and error correction* component.

In addition, the details presented in the Tamhane table revealed that the P-value between the *unity and cohesion* component and v*ocabulary* component was 0.017 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and v*ocabulary* component significantly differ at the 5% level of significance. The difference of the mean value of the two components is 2.29268 which suggested that the *unity and cohesion* component had a higher mean score compared to the v*ocabulary* component.

**b) Post-hoc analysis for differences among mean scores in relation to gender**

While significant differences were found among the overall mean scores of the students who underwent the technology-enabled language enhancement program to develop written communication skills of the various components of written communication skills in pre-test and post test in relation to gender, a test for homogeneity of variances was carried out for a further post-hoc analysis to determine the data sets among which the differences lied. Details of the test of homogeneity of variances in relation to gender have been provided in Table 4.19

**Table 4.19** Test of Homogeneity of Variances for overall scores in relation to gender

| Gender | Levene Statistic | df1 | df2 | Sig. |
|--------|------------------|-----|-----|------|
| Male   | 1.019            | 5   | 114 | 0.41 |
| Female | 9.715            | 5   | 120 | 0    |

The details of the test of homogeneity of variances presented that the P-value or value of significance for males was 0.41. Therefore, at the time of

multiple comparisons of various components for males the researcher decided to use the Tukey HSD and Tukey LSD tests.

The details of the test of homogeneity of variances presented that the P-value or value of significance for females was 0. Therefore, at the time of multiple comparisons of scores for various components of the pre-test and post-test for females the researcher decided to conduct the Tamhane test.

Details of the multiple comparisons through the Tukey HSD post-hoc test for scores of various components of the pre-test and post-test for males are presented in Table 4.20.

**Table 4.20** Multiple comparisons through Tukey HSD post-hoc test for

overall scores for males

| | | Tukey HSD | | | | |
|---|---|---|---|---|---|---|
| | | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
| (I) Components | (J) Components | | | | Lower Bound | Upper Bound |
| Logical arrangement of sentences | Grammar and Error Correction | 1.675 | 0.84421 | 0.358 | -0.7722 | 4.1222 |
| | Unity and cohesion | 1.075 | 0.84421 | 0.799 | -1.3722 | 3.5222 |
| | Vocabulary | 2.92500(*) | 0.84421 | 0.01 | 0.4778 | 5.3722 |
| | Summary Writing | 1.8 | 0.84421 | 0.278 | -0.6472 | 4.2472 |
| | Paragraph Writing | 0.825 | 0.84421 | 0.924 | -1.6222 | 3.2722 |
| Grammar and Error Correction | Logical arrangement of sentences | -1.675 | 0.84421 | 0.358 | -4.1222 | 0.7722 |
| | Unity and cohesion | -0.6 | 0.84421 | 0.98 | -3.0472 | 1.8472 |
| | Vocabulary | 1.25 | 0.84421 | 0.677 | -1.1972 | 3.6972 |
| | Summary Writing | 0.125 | 0.84421 | 1 | -2.3222 | 2.5722 |
| | Paragraph Writing | -0.85 | 0.84421 | 0.915 | -3.2972 | 1.5972 |
| Unity and cohesion | Logical arrangement of sentences | -1.075 | 0.84421 | 0.799 | -3.5222 | 1.3722 |
| | Grammar and Error Correction | 0.6 | 0.84421 | 0.98 | -1.8472 | 3.0472 |
| | Vocabulary | 1.85 | 0.84421 | 0.25 | -0.5972 | 4.2972 |
| | Summary Writing | 0.725 | 0.84421 | 0.955 | -1.7222 | 3.1722 |
| | Paragraph Writing | -0.25 | 0.84421 | 1 | -2.6972 | 2.1972 |
| Vocabulary | Logical arrangement of sentences | -2.92500(*) | 0.84421 | 0.01 | -5.3722 | -0.4778 |
| | Grammar and Error Correction | -1.25 | 0.84421 | 0.677 | -3.6972 | 1.1972 |
| | Unity and cohesion | -1.85 | 0.84421 | 0.25 | -4.2972 | 0.5972 |
| | Summary Writing | -1.125 | 0.84421 | 0.766 | -3.5722 | 1.3222 |
| | Paragraph Writing | -2.1 | 0.84421 | 0.137 | -4.5472 | 0.3472 |
| Summary Writing | Logical arrangement of sentences | -1.8 | 0.84421 | 0.278 | -4.2472 | 0.6472 |
| | Grammar and Error Correction | -0.125 | 0.84421 | 1 | -2.5722 | 2.3222 |
| | Unity and cohesion | -0.725 | 0.84421 | 0.955 | -3.1722 | 1.7222 |
| | Vocabulary | 1.125 | 0.84421 | 0.766 | -1.3222 | 3.5722 |
| | Paragraph Writing | -0.975 | 0.84421 | 0.857 | -3.4222 | 1.4722 |
| Paragraph Writing | Logical arrangement of sentences | -0.825 | 0.84421 | 0.924 | -3.2722 | 1.6222 |
| | Grammar and Error Correction | 0.85 | 0.84421 | 0.915 | -1.5972 | 3.2972 |
| | Unity and cohesion | 0.25 | 0.84421 | 1 | -2.1972 | 2.6972 |
| | Vocabulary | 2.1 | 0.84421 | 0.137 | -0.3472 | 4.5472 |
| | Summary Writing | 0.975 | 0.84421 | 0.857 | -1.4722 | 3.4222 |

The details presented in the Tukey HSD table for males table revealed that the P-value between the *logical arrangement of sentences* component and *vocabulary* component was 0.01 which is less than 0.05. This suggested that the mean score between the *logical arrangement of sentences* component and *vocabulary* component significantly differ at the 5% level of significance. The difference of the mean value of the two components is 2.92500 which suggested that the *logical arrangement of sentences* component had a higher mean score compared to the *vocabulary* component.

Details of the multiple comparisons through the Tukey LSD post-hoc test for scores of the pre-test and post-test for males are presented in Table 4.21.

**Table 4.21** Multiple comparisons through Tukey LSD post-hoc test for

overall scores for males

| | | Tukey LSD | | | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| (I) Components | (J) Components | Mean Difference (I-J) | Std. Error | Sig. | | |
| | | | | | Lower Bound | Upper Bound |
| Logical arrangement of sentences | Grammar and Error Correction | 1.67500(*) | 0.84421 | 0.05 | 0.0026 | 3.3474 |
| | Unity and cohesion | 1.075 | 0.84421 | 0.205 | -0.5974 | 2.7474 |
| | Vocabulary | 2.92500(*) | 0.84421 | 0.001 | 1.2526 | 4.5974 |
| | Summary Writing | 1.80000(*) | 0.84421 | 0.035 | 0.1276 | 3.4724 |
| | Paragraph Writing | 0.825 | 0.84421 | 0.331 | -0.8474 | 2.4974 |
| Grammar and Error Correction | Logical arrangement of sentences | -1.67500(*) | 0.84421 | 0.05 | -3.3474 | -0.0026 |
| | Unity and cohesion | -0.6 | 0.84421 | 0.479 | -2.2724 | 1.0724 |
| | Vocabulary | 1.25 | 0.84421 | 0.141 | -0.4224 | 2.9224 |
| | Summary Writing | 0.125 | 0.84421 | 0.883 | -1.5474 | 1.7974 |
| | Paragraph Writing | -0.85 | 0.84421 | 0.316 | -2.5224 | 0.8224 |
| Unity and cohesion | Logical arrangement of sentences | -1.075 | 0.84421 | 0.205 | -2.7474 | 0.5974 |
| | Grammar and Error Correction | 0.6 | 0.84421 | 0.479 | -1.0724 | 2.2724 |
| | Vocabulary | 1.85000(*) | 0.84421 | 0.03 | 0.1776 | 3.5224 |
| | Summary Writing | 0.725 | 0.84421 | 0.392 | -0.9474 | 2.3974 |
| | Paragraph Writing | -0.25 | 0.84421 | 0.768 | -1.9224 | 1.4224 |
| Vocabulary | Logical arrangement of sentences | -2.92500(*) | 0.84421 | 0.001 | -4.5974 | -1.2526 |
| | Grammar and Error Correction | -1.25 | 0.84421 | 0.141 | -2.9224 | 0.4224 |
| | Unity and cohesion | -1.85000(*) | 0.84421 | 0.03 | -3.5224 | -0.1776 |
| | Summary Writing | -1.125 | 0.84421 | 0.185 | -2.7974 | 0.5474 |
| | Paragraph Writing | -2.10000(*) | 0.84421 | 0.014 | -3.7724 | -0.4276 |
| Summary Writing | Logical arrangement of sentences | -1.80000(*) | 0.84421 | 0.035 | -3.4724 | -0.1276 |
| | Grammar and Error Correction | -0.125 | 0.84421 | 0.883 | -1.7974 | 1.5474 |
| | Unity and cohesion | -0.725 | 0.84421 | 0.392 | -2.3974 | 0.9474 |
| | Vocabulary | 1.125 | 0.84421 | 0.185 | -0.5474 | 2.7974 |
| | Paragraph Writing | -0.975 | 0.84421 | 0.251 | -2.6474 | 0.6974 |
| Paragraph Writing | Logical arrangement of sentences | -0.825 | 0.84421 | 0.331 | -2.4974 | 0.8474 |
| | Grammar and Error Correction | 0.85 | 0.84421 | 0.316 | -0.8224 | 2.5224 |
| | Unity and cohesion | 0.25 | 0.84421 | 0.768 | -1.4224 | 1.9224 |
| | Vocabulary | 2.10000(*) | 0.84421 | 0.014 | 0.4276 | 3.7724 |
| | Summary Writing | 0.975 | 0.84421 | 0.251 | -0.6974 | 2.6474 |

The details presented in the Tukey LSD table for males revealed that the P-value between the *logical arrangement of sentences* component and *grammar and error correction* component was 0.05 which is equal to 0.05. This suggested that the mean score between the *logical arrangement of sentences* component and *grammar and error correction* component significantly differ at the 5% level of significance. The difference of the mean value of the two components is 1.67500 which suggested that the *logical arrangement of sentences* component had a higher mean score compared to the *grammar and error correction* component.

The details presented in the Tukey LSD table for males also revealed that the P-value between the *logical arrangement of sentences* component and the *summary writing* component was 0.035 which is less than 0.05. This suggested that the mean score between *logical arrangement of sentences* component and the *summary writing* component significantly differed at the 5% level of significance. The difference of the mean value of the two components was 1.80000 which suggested that the *logical arrangement of sentences* component had a higher mean score compared to the *summary writing* component.

The details presented in the Tukey LSD table for males also revealed that the P-value between the *unity and cohesion* component and the *vocabulary*

component was 0.03 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and the *vocabulary* component significantly differed at the 5% level of significance. The difference of the mean value of the two components was 1.85000 which suggested that the *unity and cohesion* component had a higher mean score compared to the *vocabulary* component.

Details of the multiple comparisons through the Tamhane post-hoc test for scores of various components for the pre-test and post-test for females are presented in Table 4.22.

**Table 4.22** Multiple comparisons through Tamhane post-hoc test for scores

for females

| (I) Components | (J) Components | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Logical arrangement of sentences | Grammar and Error Correction | 0.66667 | 0.73536 | 0.999 | -1.6603 | 2.9937 |
| | Unity and cohesion | -1.71429 | 0.7109 | 0.289 | -3.981 | 0.5524 |
| | Vocabulary | 1 | 1.06806 | 0.999 | -2.342 | 4.342 |
| | Summary Writing | 0.47619 | 0.78899 | 1 | -1.9949 | 2.9473 |
| | Paragraph Writing | -0.07143 | 0.66377 | 1 | -2.2359 | 2.0931 |
| Grammar and Error Correction | Logical arrangement of sentences | -0.66667 | 0.73536 | 0.999 | -2.9937 | 1.6603 |
| | Unity and cohesion | -2.38095(*) | 0.47998 | 0 | -3.8774 | -0.8845 |
| | Vocabulary | 0.33333 | 0.93046 | 1 | -2.6531 | 3.3198 |
| | Summary Writing | -0.19048 | 0.5895 | 1 | -2.032 | 1.6511 |
| | Paragraph Writing | -0.7381 | 0.40693 | 0.714 | -2.0346 | 0.5584 |
| Unity and cohesion | Logical arrangement of sentences | 1.71429 | 0.7109 | 0.289 | -0.5524 | 3.981 |
| | Grammar and Error Correction | 2.38095(*) | 0.47998 | 0 | 0.8845 | 3.8774 |
| | Vocabulary | 2.71429 | 0.91125 | 0.091 | -0.2305 | 5.659 |
| | Summary Writing | 2.19048(*) | 0.55869 | 0.006 | 0.4357 | 3.9452 |
| | Paragraph Writing | 1.64286(*) | 0.36085 | 0.001 | 0.5018 | 2.784 |
| Vocabulary | Logical arrangement of sentences | -1 | 1.06806 | 0.999 | -4.342 | 2.342 |
| | Grammar and Error Correction | -0.33333 | 0.93046 | 1 | -3.3198 | 2.6531 |
| | Unity and cohesion | -2.71429 | 0.91125 | 0.091 | -5.659 | 0.2305 |
| | Summary Writing | -0.52381 | 0.9734 | 1 | -3.612 | 2.5644 |
| | Paragraph Writing | -1.07143 | 0.87498 | 0.982 | -3.9455 | 1.8027 |
| Summary Writing | Logical arrangement of sentences | -0.47619 | 0.78899 | 1 | -2.9473 | 1.9949 |
| | Grammar and Error Correction | 0.19048 | 0.5895 | 1 | -1.6511 | 2.032 |
| | Unity and cohesion | -2.19048(*) | 0.55869 | 0.006 | -3.9452 | -0.4357 |
| | Vocabulary | 0.52381 | 0.9734 | 1 | -2.5644 | 3.612 |
| | Paragraph Writing | -0.54762 | 0.49733 | 0.993 | -2.1501 | 1.0549 |
| Paragraph Writing | Logical arrangement of sentences | 0.07143 | 0.66377 | 1 | -2.0931 | 2.2359 |
| | Grammar and Error Correction | 0.7381 | 0.40693 | 0.714 | -0.5584 | 2.0346 |
| | Unity and cohesion | -1.64286(*) | 0.36085 | 0.001 | -2.784 | -0.5018 |
| | Vocabulary | 1.07143 | 0.87498 | 0.982 | -1.8027 | 3.9455 |
| | Summary Writing | 0.54762 | 0.49733 | 0.993 | -1.0549 | 2.1501 |

The details presented in the Tamhane table for females revealed that the P-value between the *unity and cohesion* component and the *grammar and error correction* component is 0 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and *grammar and error correction* component significantly differ at the 5% level of significance. The difference of the mean value of the two components was 2.38095 which suggested that the *unity and cohesion* component had a higher mean score compared to *grammar and error correction* component.

The details presented in the Tamhane table for females also revealed that the P -value between the *unity and cohesion* component and the *summary writing* component was 0.006 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and the *summary writing* component significantly differed at the 5% level of significance. The difference of the mean value of the two components was 2.19048 which suggested that the *unity and cohesion* component had a higher mean score compared to the *summary writing* component.

The details presented in the Tamhane table for females also revealed that the P -value between the *unity and cohesion* component and the *paragraph writing* component was 0.001 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and the

*paragraph writing* component significantly differed at the 5% level of significance. The difference of the mean value of the two components was 1.64286 which suggested that the *unity and cohesion* component had a higher mean score compared to *grammar and error correction* component.

**c) Post-hoc analysis for differences among mean scores in relation to program major**

While another finding from the analysis could establish that there were no significant differences among the overall mean scores of the students who underwent the technology-enabled language enhancement program to develop written communication skills of the various components of written communication skills in pre-test and post test in relation to degree program major, a test for homogeneity of variances was carried out for a further post-hoc analysis to determine the data sets among which the differences lied. Details of the test of homogeneity of variances in relation to degree program major have been provided in Table 4.23

**Table 4.23** Test of Homogeneity of Variances in relation to degree program major

| Program | Levene Statistic | df1 | df2 | Sig. |
|---------|------------------|-----|-----|------|
| **BBA** | 4.93 | 5 | 150 | 0.000 |
| **NON-BBA** | 3.97 | 5 | 84 | 0.003 |

Also, at the time of multiple comparisons we the researcher decided to use the Tamhane test for BBA majors since the mean score significantly differed with the P-value being 0.000 at the 5% level of significance. Since there was no significant difference for the Non-BBA majors, no further multiple comparisons through post-hoc tests were required.

Details of the multiple comparisons through the Tamhane post-hoc test scores of various components for the pre-test and post-test for BBA majors are presented in Table 4.24.

**Table 4.24** Multiple comparisons through Tamhane post-hoc test for scores

for BBA majors

| Tamhane | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval | |
| (I) Components | (J) Components | Mean Difference (I-J) | Std. Error | Sig. | Lower Bound | Upper Bound |
| Logical arrangement of sentences | Grammar and Error Correction | 1.05769 | 0.74482 | 0.93 | -1.2514 | 3.3668 |
| | Unity and cohesion | -0.25 | 0.7333 | 1 | -2.5278 | 2.0278 |
| | Vocabulary | 2.21154 | 0.89811 | 0.23 | -0.5497 | 4.9727 |
| | Summary Writing | 1.61538 | 0.75689 | 0.444 | -0.7271 | 3.9578 |
| | Paragraph Writing | 0.44231 | 0.68221 | 1 | -1.7044 | 2.589 |
| Grammar and Error Correction | Logical arrangement of sentences | -1.05769 | 0.74482 | 0.93 | -3.3668 | 1.2514 |
| | Unity and cohesion | -1.30769 | 0.55725 | 0.294 | -3.0211 | 0.4057 |
| | Vocabulary | 1.15385 | 0.76119 | 0.89 | -1.2085 | 3.5162 |
| | Summary Writing | 0.55769 | 0.58796 | 0.998 | -1.2501 | 2.3655 |
| | Paragraph Writing | -0.61538 | 0.48808 | 0.973 | -2.1265 | 0.8957 |
| Unity and cohesion | Logical arrangement of sentences | 0.25 | 0.7333 | 1 | -2.0278 | 2.5278 |
| | Grammar and Error Correction | 1.30769 | 0.55725 | 0.294 | -0.4057 | 3.0211 |
| | Vocabulary | 2.46154(*) | 0.74991 | 0.031 | 0.1295 | 4.7935 |
| | Summary Writing | 1.86538(*) | 0.57328 | 0.03 | 0.1019 | 3.6289 |
| | Paragraph Writing | 0.69231 | 0.4703 | 0.909 | -0.7613 | 2.1459 |
| Vocabulary | Logical arrangement of sentences | -2.21154 | 0.89811 | 0.23 | -4.9727 | 0.5497 |
| | Grammar and Error Correction | -1.15385 | 0.76119 | 0.89 | -3.5162 | 1.2085 |
| | Unity and cohesion | -2.46154(*) | 0.74991 | 0.031 | -4.7935 | -0.1295 |
| | Summary Writing | -0.59615 | 0.773 | 1 | -2.9908 | 1.7985 |
| | Paragraph Writing | -1.76923 | 0.70004 | 0.219 | -3.9745 | 0.436 |
| Summary Writing | Logical arrangement of sentences | -1.61538 | 0.75689 | 0.444 | -3.9578 | 0.7271 |
| | Grammar and Error Correction | -0.55769 | 0.58796 | 0.998 | -2.3655 | 1.2501 |
| | Unity and cohesion | -1.86538(*) | 0.57328 | 0.03 | -3.6289 | -0.1019 |
| | Vocabulary | 0.59615 | 0.773 | 1 | -1.7985 | 2.9908 |
| | Paragraph Writing | -1.17308 | 0.50631 | 0.32 | -2.7434 | 0.3972 |
| Paragraph Writing | Logical arrangement of sentences | -0.44231 | 0.68221 | 1 | -2.589 | 1.7044 |
| | Grammar and Error Correction | 0.61538 | 0.48808 | 0.973 | -0.8957 | 2.1265 |
| | Unity and cohesion | -0.69231 | 0.4703 | 0.909 | -2.1459 | 0.7613 |
| | Vocabulary | 1.76923 | 0.70004 | 0.219 | -0.436 | 3.9745 |
| | Summary Writing | 1.17308 | 0.50631 | 0.32 | -0.3972 | 2.7434 |

The details presented in the Tamhane table for BBA majors revealed that the P-value between the *unity and cohesion* component and the *vocabulary* component was 0.031 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and the *vocabulary* component significantly differed at the 5% level of significance. The difference of the mean value of the two components was 2.46154 which suggested that the *unity and cohesion* component had a higher mean score compared to the *vocabulary* component.

The details presented in the Tamhane table for BBA majors also revealed that the P-value between the *unity and cohesion* component and the *summary writing* component was 0.03 which is less than 0.05. This suggested that the mean score between the *unity and cohesion* component and the *summary writing* component significantly differed at the 5% level of significance. The difference of the mean value of the two components was 1.86538 which suggested that the *unity and cohesion* component had a higher mean score compared to the *summary writing* component.

**4.5 Online questionnaire for program evaluation**

In addition to an analysis of the pre-test scores and post-test scores that measured the effectiveness of the technology-enabled language learning program in terms of the enhancement of writing skills, an online questionnaire was also sent out to the participants to evaluate the technology-enabled language enhancement program. The evaluation of the technology-enabled language enhancement program clarified how the participants perceived their experiences of the usefulness of technology in enhancing their writing skills in English. First a descriptive analysis of the responses to the answers in the survey was carried out to identify the overall characteristics of the evaluation of the program. Then, correlations among various components of the program were computed to examine their relationships.

**4.5.1 Descriptive analysis of questionnaire**

Of the 41 participants who underwent the technology-enabled language enhancement program, 37 of them responded to the survey, which showed an 82% response rate for the survey. Along the five-point Likert scale, averages of 3.5 or higher are generally considered high use or positive attitude, averages of 2.5 – 3.4 medium use or medium degree of support, and

averages of 2.4 or lower, low use or low degree of support.(Oxford and Burry-Stock, 1995). While some items on the questionnaire got an average of 3, most items on the questionnaire had an average of 3.5 or higher which showed that the technology enabled program received a positive evaluation.

**a) Overall evaluation of program**

An overall evaluation of the program revealed that there was a generally high degree of agreement for the items on the questionnaire. Participants enjoyed the program overall which could be reflected with the mean score of 3.59 and standard deviation of .798.

**Table 4.25** Overall enjoyment scores

| Item | Mean | Std. Deviation | N |
|------|------|----------------|---|
| I enjoyed the program overall | 3.59 | .798 | 37 |

**b) Comprehensibility**

Participants showed a high degree of agreement for the comprehension component of the program with a mean score of 3.676 and a standard deviation of .7379. Table 4.26 displays details on the comprehension component of the online survey.

**Table 4.26** Comprehensibility scores

| Item | Mean | Std. Deviation | N |
|------|------|----------------|---|
| The instructions provided in the units were easy to follow | 3.59 | .798 | 37 |
| The questions given in the different sections of the unit were easy to follow | 3.84 | .646 | 37 |
| I could incorporate all the requirements of each of the activities | 3.59 | .725 | 37 |

**c) Accessibility**

The *accessibility* component showed that most students accessed the program from more than one place with the mean score of 1.405. The technology enabled language enhancement program was accessed mostly by the participants mostly from their hostel rooms, followed by the computer lab on campus, home, and lastly any other place on campus or other portable devices used elsewhere. Figure 4.4 shows details of the accessibility by participants of the technology enabled language enhancement program.

**Figure 4.4** Ease of access details
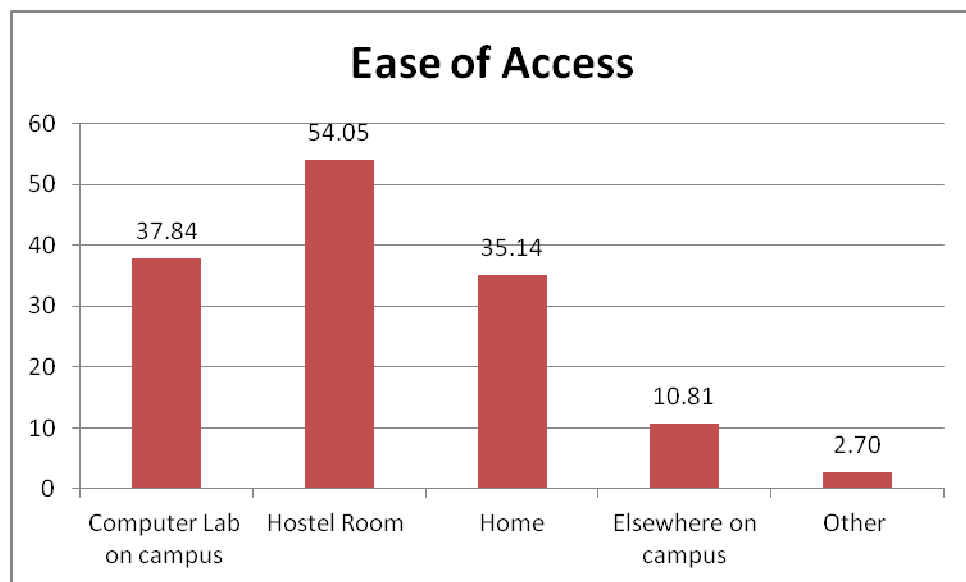
**d) Time**

So far as the time frame for the task completion was concerned the participants also responded positively with a mean score of 3.46 and a standard deviation of .900. Table 4.27 provides details about the time requirement fulfilment of the participants.

**Table 4.27** Time frame scores

| Item | Mean | Std. Deviation | N |
|------|------|----------------|---|
| I could finish the tasks in the given time-frame | 3.46 | .900 | 37 |

**e) Resource enjoyment**

The *resource enjoyment* component showed that most students enjoyed more than one resource made available in the program the mean score of 1.378. The resources within technology enabled language enhancement program that were enjoyed the most were the TV or movie realted websites, followed by the travel websites, then the online news articles, then the current issue audio link and lastly the controversial issue video link. Figure 4.5 shows details of the resource enjoyment by percentage in the technology enabled language enhancement program.

**Figure 4.5** Resource enjoyment details
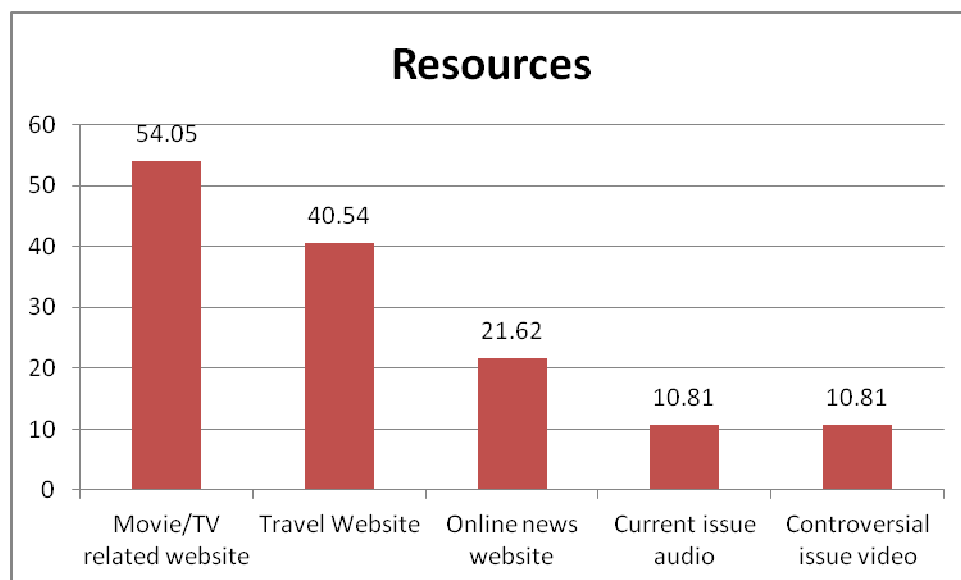
Additionally, when asked about their comfort and other aspects for using the various resources in the program, participants showed a high degree of agreement with a mean score of 3.50 and a standard deviation of .878. Table 4.28 displays details on the resources component of the online survey.

**Table 4.28** Resources enjoyment scores

| Item | Mean | Std. Deviation | N |
|---|---|---|---|
| I was comfortable with searching for information/resources on the Internet as required by various tasks | 3.68 | .784 | 37 |
| I enjoyed the process of searching for various resources (online news reports, videos, etc.) that were required for the given tasks | 3.32 | .973 | 37 |
| The resources used in the activities provided me with an opportunity to enhance my English language proficiency | 3.76 | .683 | 37 |

**f) Interactivity and feedback**

Participants also showed a high degree of agreement for the interactivity and feedback component of the program with a mean score of 3.4125 and a standard deviation of .827. Table 4.29 displays details on the interactivity and feedback component of the online survey.

**Table 4.29** Interactivity and feedback scores

| Item | Mean | Std. Deviation | N |
|---|---|---|---|
| I enjoyed reading what my classmates had posted onto the online discussion forum | 3.38 | .861 | 37 |
| I enjoyed reviewing my classmates' work online / electronically | 3.32 | .973 | 37 |
| The feedback I received from my classmate(s) was useful in improving my work before submission | 3.38 | .861 | 37 |
| I incorporated the feedback received from my classmate(s) into my work online as required. | 3.78 | .584 | 37 |

**g) Self-Perception**

Participants also showed a high degree of agreement for the self-perception of language achievement item of the program with a mean score of 3.70 and a standard deviation of .661. Table 4.30 displays details on the interactivity and feedback component of the online survey.

**Table 4.30** Self-perception scores

| Item | Mean | Std. Deviation | N |
|---|---|---|---|
| I could produce a reasonably good piece of written text at the end of each activity | 3.70 | .661 | 37 |

**h) Attitudes to technology**

Participants also showed a high degree of agreement for the attitudes towards technology component of the program with a mean score of 3.59 and a standard deviation of .852. Table 4.31 displays details on the interactivity and feedback component of the online survey.

**Table 4.31** Attitudes towards technology scores

| Item | Mean | Std. Deviation | N |
|---|---|---|---|
| I was comfortable with using different forms of technology for studying English | 3.65 | .753 | 37 |
| I enjoyed doing the technology-based tasks | 3.27 | 1.045 | 37 |
| The technology-based activities in the program provided me with an opportunity to enhance my Writing Skills in English | 3.76 | .597 | 37 |
| I would like to continue using various forms of technology to enhance my English Language Skills | 3.57 | .835 | 37 |

Thus, the questionnaire covered items that evaluated various features of the program, thereby eliciting the opinions on the technology-enabled language enhancement program administered to them as part of the treatment.

## 4.5.2 Correlations between various components of questionnaire

For a detailed evaluation of the relationships between various components of the technology enabled language enhancement program, Pearson's product-moment correlation analysis was conducted. The areas that were computed for the correlation analysis were overall program enjoyment, accessibility, time, comprehensibility, resource enjoyment, interactivity and feedback, self-perception, and attitudes towards technology. Significant positive correlations were found between the several components of the questionnaire.

### a) Overall program enjoyment

Participants who enjoyed the technology enabled language enhancement program overall, also enjoyed several individual aspects of the program.

The first significant correlation coefficient was found between the overall enjoyment component and resource enjoyment component with a value of 0.445 which was significant at the 0.01 level of significance. This meant that the participants who enjoyed the program overall, were not only comfortable with, but also, enjoyed the process of searching for various resources on the internet. While they enjoyed the use of the various resources from the

internet in the program, they also felt that the resources provided them with an opportunity to enhance their English language skills and proficiency. Thus, a positive significant correlation was noted among the among the participants' overall program enjoyment and resource enjoyment. Table 4.32 provides details about the Pearson's correlation between overall program enjoyment and resource enjoyment.

**Table 4.32** Pearson's correlation between overall program enjoyment and resource enjoyment

|  |  | Resource Enjoyment |
| --- | --- | --- |
| Overall Program Enjoyment | Pearson Correlation | .445[**] |
|  | Sig. (2-tailed) | .006 |

The second significant correlation coefficient was found between the overall enjoyment component and interactivity and feedback component with a value of 0.403 which was significant at the 0.05 level of significance. This meant that the participants who enjoyed the program overall, enjoyed reading what their classmates had posted onto the online discussion forum and reviewing my classmates' work online or electronically. Moreover, the participants perceived that the feedback received from their classmates was useful in improving their work before their final electronic submission. In addition, the participants also made sure that they incorporated the feedback

received from their classmates into their work online as required. Thus, a positive significant correlation was observed among the participants' overall program enjoyment and the interactivity and feedback component of the program. Table 4.33 provides details about the Pearson's correlation between overall program enjoyment and interactivity and feedback.

**Table 4.33** Pearson's correlation between overall program enjoyment and interactivity and feedback

| | | Interactivity and Feedback |
|---|---|---|
| Overall Program Enjoyment | Pearson Correlation | .403[*] |
| | Sig. (2-tailed) | .014 |

The third significant correlation coefficient was found between the overall enjoyment component and self-perception component with a value of 0.555 which was significant at the 0.01 level of significance. This meant that the participants who enjoyed the program overall, also perceived that they could produce a reasonably good piece of written text at the end of each activity. Thus, a positive significant correlation was observed among the participants' overall program enjoyment and the self-perception component of the

program. Table 4.34 provides details about the Pearson's correlation between overall program enjoyment and self-perception.

**Table 4.34** Pearson's correlation between overall program enjoyment and self-perception

|  |  | Self-perception |
| --- | --- | --- |
| Overall Program Enjoyment | Pearson Correlation | .555[**] |
|  | Sig. (2-tailed) | .000 |

The fourth significant correlation coefficient was found between the overall enjoyment component and the attitudes towards technology component with a value of 0.469 which was significant at the 0.01 level of significance. This meant that the participants who enjoyed the program overall, also had a positive attitude towards the use of technology in language learning. This included attitudes such as being comfortable with using technology for English language learning and enjoying the technology-based tasks in the program. The participants also felt that the technology—based activities in the program provided them with an opportunity to enhance their English language skills and proficiency. Moreover, they were also positive about the fact that they would like to continue using various forms of technology to enhance their English language skills. Thus, a positive significant

correlation was observed among the participants' overall program enjoyment and the attitudes towards technology component of the program. Table 4.35 provides details about the Pearson's correlation between overall program enjoyment and attitudes to technology.

**Table 4.35** Pearson's correlation between overall program enjoyment and attitudes to technology

| | | Attitudes to technology |
|---|---|---|
| Overall Program Enjoyment | Pearson Correlation | .469[**] |
| | Sig. (2-tailed) | .003 |

## b) Attitudes to technology

It was noted that the participants' attitudes to technology highly correlated with several other components of the technology-enabled language enhancement program. The attitudes to technology included aspects such as comfort, enjoyment, and provision of opportunities, and continuation in the future use of technology-based tasks to enhance their English language skills and proficiency. While the attitudes to technology and overall program enjoyment were highly correlated, other significant correlations were also found.

A significant correlation was found between attitudes towards technology and the comprehensibility component of the program with a value of 0.601 which was significant at the 0.01 level of significance. This meant that the participants, who had a positive attitude towards the use of technology in language learning, were also able to comprehend various elements of the program. The comprehensibility of the program meant that the participants were able to comprehend various elements of the program, such as instructions and questions regarding the requirement and submissions of different tasks, activities, and assignments. Thus, a positive significant correlation was observed among the participants' attitudes towards technology and the comprehensibility component of the program. Table 4.36 provides details about the Pearson's correlation between attitudes towards technology and comprehensibility of the program.

**Table 4.36** Pearson's correlation between attitudes towards technology and comprehensibility

|  |  | Comprehensibility |
|---|---|---|
| Attitudes to Technology | Pearson Correlation | .601** |
|  | Sig. (2-tailed) | .000 |

Another significant correlation was found between attitudes towards technology and the resource enjoyment component of the program with a

value of 0.572 which was significant at the 0.01 level of significance. This meant that the participants, who had a positive attitude towards the use of technology in language learning, were not only comfortable with, but also enjoyed the process of searching for various resources on the internet. While they enjoyed the use of the various resources from the internet in the program, they also felt that the resources provided them with an opportunity to enhance their English language skills and proficiency. Thus, a positive significant correlation was noticed among the participants' attitudes towards technology and the resource enjoyment component of the program. Table 4.37 provides details about the Pearson's correlation between attitudes towards technology and the resource enjoyment of the program.

**Table 4.37** Pearson's correlation between attitudes towards technology and resource enjoyment

|  |  | Resource Enjoyment |
| --- | --- | --- |
| Attitudes to Technology | Pearson Correlation | .572** |
|  | Sig. (2-tailed) | .000 |

In addition, a significant correlation was found between attitudes towards technology and the interactivity and feedback component of the program with a value of 0.541 which was significant at the 0.01 level of significance. This meant that the participants, who had a positive attitude towards the use

of technology in language learning, were not only comfortable with, but also enjoyed interacting with their classmates in different ways, such as, reading what their classmates had posted onto the online discussion forum, reviewing classmates' work online or electronically, incorporating the feedback received from their classmates into their work online as required. Thus, a positive significant correlation was noticed among the participants' attitudes towards technology and the interactivity and feedback component of the program. Table 4.38 provides details about the Pearson's correlation between attitudes towards technology and interactivity and feedback of the program.

**Table 4.38** Pearson's correlation between attitudes towards technology and interactivity and feedback

|  |  | Interactivity and Feedback |
|---|---|---|
| Attitudes to Technology | Pearson Correlation | .541** |
|  | Sig. (2-tailed) | .001 |

## c) Comprehensibility

In addition to a correlation being seen between comprehensibility and attitudes towards technology in the program, significant correlations found between comprehensibility and other aspects of the program as well.

A significant correlation was found between comprehensibility and ease of access of the technology-enabled language enhancement program. The value of significance was 0.547 which was significant at the 0.01 level of significance. The program could be accessed from various venues, including the hostel rooms, homes, computers labs on campus, anywhere else on campus on their own devices such as the laptops or mobile devices. This meant that provision of opportunities for comprehensibility of the program could be related to the possibility of the ease of access of the program from anywhere and at any time. Thus, a positive significant correlation was noted among the among the participants' comprehensibility and ease of access. Table 4.39 provides details about the Pearson's correlation between comprehensibility and ease of access.

**Table 4.39** Pearson's correlation between comprehensibility and ease of access

|  |  | Ease of Access |
|---|---|---|
| Comprehensibility | Pearson Correlation | .547** |
|  | Sig. (2-tailed) | .000 |

Another significant correlation was found between comprehensibility of the program and time given for activities within the technology-enabled

language enhancement program. The value of significance was 0.609 which was significant at the 0.01 level of significance. This meant that as the comprehensibility of various aspects of the program was directly related to the given time frame and time spent on various activities of the program. Thus, a positive significant correlation was noted between the comprehensibility and time frame of the program. Table 4.40 provides details about the Pearson's correlation between comprehensibility and time.

**Table 4.40** Pearson's correlation between comprehensibility and time

|  |  | Time |
|---|---|---|
| Comprehensibility | Pearson Correlation | .609** |
|  | Sig. (2-tailed) | .000 |

In addition, significant correlation coefficient was found between the comprehensibility component and resource enjoyment component with a value of 0.408 which was significant at the 0.05 level of significance. This meant that the participants who were able to comprehend various elements of the program, such as instructions and questions regarding submission requirement of tasks, activities, and assignments, were not only comfortable with, but also enjoyed the process of searching for various resources on the internet. While they enjoyed the use of the various resources from the internet in the program, they also felt that the resources provided them with

an opportunity to enhance their English language skills and proficiency. Thus, a positive significant correlation was noted among the among the participants' comprehensibility of the program and resource enjoyment. Table 4.41 provides details about the Pearson's correlation between comprehensibility and resource enjoyment.

**Table 4.41** Pearson's correlation between comprehensibility and resource enjoyment

|                   |                     | Resource Enjoyment |
|-------------------|---------------------|--------------------|
| Comprehensibility | Pearson Correlation | .408*              |
|                   | Sig. (2-tailed)     | .012               |

Moreover, a significant correlation coefficient was found between the comprehensibility component and interactivity and feedback component with a value of 0.354 which was significant at the 0.05 level of significance. This meant that the participants, who were able to comprehend various elements of the program, enjoyed reading what their classmates had posted onto the online discussion forum and reviewing my classmates' work online or electronically. Participants also perceived that the feedback received from their classmates was useful in improving their work before their final electronic submission and as result also incorporated the feedback received from my classmate(s) into their work online as required. Thus, a positive

significant correlation was observed between comprehensibility and the interactivity and feedback component of the program. Table 4.42 provides details about the Pearson's correlation between comprehensibility and interactivity and feedback.

**Table 4.42** Pearson's correlation between comprehensibility component and interactivity and feedback

|  |  | Interactivity and Feedback |
|---|---|---|
| Comprehensibility | Pearson Correlation | .354* |
|  | Sig. (2-tailed) | .031 |

### d) Resource enjoyment

In addition to a correlation being seen between resource enjoyment and three aspects of the program, that is, overall program enjoyment, attitudes towards technology, and comprehensibility, there were significant correlations found between resource enjoyment and other aspects of the program as well.

A significant correlation coefficient was found between the resource enjoyment component and interactivity and feedback component with a

value of 0.604 which was significant at the 0.01 level of significance. This meant that the participants who enjoyed the process of searching and using various resources from the internet in the program, and who felt that the resources provided them with an opportunity to enhance their English language skills and proficiency, also enjoyed interacting with their classmates in different ways, such as reading what their classmates had posted onto the online discussion forum, reviewing classmates' work online or electronically, incorporating the feedback received from their classmates into their work online as required. Thus, a positive significant correlation was noted among the among the participants' resource enjoyment and interactivity and feedback. Table 4.43 provides details about the Pearson's correlation between resource enjoyment and interactivity and feedback.

**Table 4.43** Pearson's correlation between resource enjoyment and interactivity and feedback

|  |  | Interactivity and Feedback |
|---|---|---|
| Resource Enjoyment | Pearson Correlation | .604* |
|  | Sig. (2-tailed) | .000 |

In addition, a significant correlation was found between resource enjoyment component and self-perception of students. The value of significance was 0.376 which was significant at the 0.05 level of significance. This meant that

the amount of participants who enjoyed processes involved with the use of online resources in the program was directly related to the self-perception of students' writing skills. Thus, a positive significant correlation was noted between resource enjoyment and self-perception of students' writing skills. Table 4.44 provides details about the Pearson's correlation between time and self-perception.

**Table 4.44** Pearson's correlation between resource enjoyment and comprehensibility

|  |  | Self-Perception |
| --- | --- | --- |
| Resource Enjoyment | Pearson Correlation | .376* |
|  | Sig. (2-tailed) | .022 |

Thus, a correlation analysis confirmed significant relationships among various that there were significant correlations among various components of the questionnaire.

## 4.6 Conclusion

The chapter presented the analyses and interpretation of data generated from the research through different tools used at various stages of the study. With a restatement of the hypotheses, the effectiveness of the technology-enabled language enhancement program was evaluated with the quantitative results from the data collected by means of the tests examined through the statistical procedures of T-test and ANOVA. The data collected from the pre-test and post-test scores rejected the null hypotheses of the study. This showed that, in terms of performance and achievement, the technology-enabled language enhancement program was effective in developing written communication skills of students at the tertiary level. In addition to the quantitative analysis of the data, as a means of evaluating the technology-enabled language enhancement program from the students' perspective, a detailed evaluation of results through a descriptive and correlation analysis of various components of the questionnaire administered to students after completion of the writing program was provided. Thus, the quantitative and qualitative data analyses of the results showed that the technology-enabled language enhancement program was effective in developing the written communication skills of the ESL learners at the tertiary level.