CHAPTER- IV

DATA ANALYSIS, INTERPRETATION AND DISCUSSION

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4.0.0 INTRODUCTION

Finding solutions and making rational decision to a problem is the outcome of systematic analysis and interpretation of the data. The present chapter deals with the analysis and interpretation of data collected during experimentation and to have a sound discussion on the basis of the findings derived from the analysis and interpretation of data. Any unprocessed data to be substantial information has to undergo analysis, followed by its meaningful interpretation. It is very much essential to identify suitable and appropriate analysis techniques. An analysis helps the data to be reduced to understandable and interpretable form. Its basic purpose was to summarize the completed observations in such a manner that they yield answers to the research problems and the purpose of interpretation was to search for broader meaning of these answers. It helps in the building up of the relationship between the data and subsequently aids to reduce the values to a solitary meaningful value that is comparable, understandable and further interpretable by the readers. The main purpose of analysis and interpretation is to assess and determine the extent of attainment of objectives of the taken research. Analysis of the research data also helps the researcher to test the hypothesis of the research study. This helps the researcher to makes conclusion and decision for formulation of the theory. Any research study cannot be completed without data analysis and interpretation therefore this process cannot be undermined.

The present study is an experimental study following quasi experimental research design. The data were collected by the researcher by administering achievement test in three phases viz. pre-test, post-test and delayed post-test on both control group and experimental group. The pre-test achievement score was used to make control group and experimental group equivalent. After making the group equivalent there were 22 students in both experimental and control group. Though the post-testing and delayed post-testing were done on all the students of experimental and control group, only the data of both the equivalent groups with 22 students in each group were analysed to

achieve the objectives of present study. As the nature of data was quantitative, the quantitative statistical techniques were adopted for analysis of data. The statistical techniques like Mean, Standard Deviation (SD), Standard Error of Mean (SE) and Mann–Whitney U-test were used to attain different objectives of the present study.

The following formulae were used for deriving the Non–parametric statistics, Mann–Whitney U-test.

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - \sum R_1$$

Where,

n_1 = number in one group

$\sum R_1$ = sum of ranks in one group

n_2 = number in second group

To calculate and determine the z-value, the researcher used the following formula.

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{n_1 n_2 (n_1+n_2+1)}{12}}}$$

The selection of the sample was purposive and the assumptions of parametric statistics did not match for the present data, hence it became the cause for the researcher to favour the use of Mann–Whitney U-test. Exhaustive analysis of data is presented as follow. To make the analysis and interpretation of the data according to the objectives and hypotheses of the present study the objectives and hypotheses are stated further in the present chapter.

4.1.0 OBJECTIVES OF THE STUDY

The present was designed with the following objectives.

1. To design and develop cartoon and comics based multimedia package for teaching environment to primary students.
2. To study the effectiveness of the developed cartoon and comics based multimedia package in terms of the achievement of primary students in environment.

3. To study the delayed effect of developed cartoon and comics based multimedia package in terms of the achievement of the primary students in environment.
4. To study the effectiveness of developed cartoon and comics based multimedia package in terms of the reaction of primary students.

4.2.0 HYPOTHESES

The following null hypotheses were formulated to achieve the said objectives of the proposed study and to be tested at 0.01 level of significance.

1. There will be no significance difference between the mean post-test achievement scores of primary students in Environment studied Environment through cartoon and comics based multimedia package and traditional method.
2. There will be no significance difference between the mean post-test achievement score and mean delayed post-test achievement score of primary students in Environment studied Environment using cartoon and comics based multimedia package.
3. There will be no significance difference between the mean post-test achievement score and mean delayed post-test achievement score of primary students in Environment studied Environment through traditional method.
4. There will be no significance difference between the mean delayed post-test achievement scores in Environment of primary students studied Environment using Cartoon and Comics Based multimedia package and Traditional method.

4.3.0 ACHIEVEMENT OF EXPERIMENTAL AND CONTROL GROUP STUDENTS IN ENVIRONMENT

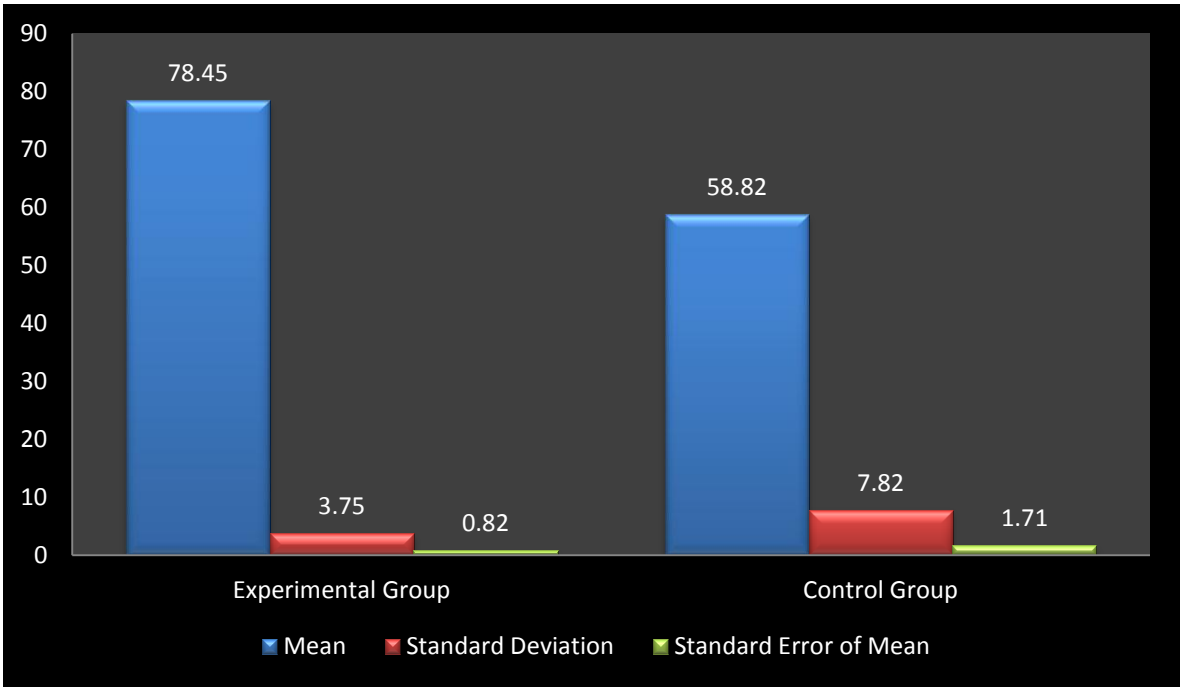
To achieve objective 2 of the present study i.e. ` To study the effectiveness of the developed cartoon and comics based multimedia package in terms of the achievement of primary students in environment' and to test the null hypothesis 1 of the present study i.e. 'There will be no significance difference between the mean post-test

achievement scores of primary students in Environment studied Environment through cartoon and comics based multimedia package and traditional method', data were analyzed using Mean, Standard Deviation and Mann-Whitney U-test which is given and discussed in table 4.1 and table 4.2.

Table 4.1: Mean, Standard Deviation and Standard Error of Mean Wise Distribution of Achievement of Students of Experimental and Control Groups in Environment

Achievement in Environment	N	Mean	Standard Deviation	Standard Error of Mean
Experimental Group	22	78.45	3.75	0.82
Control Group	22	58.82	7.82	1.71

Figure 4.1: Graph showing Mean, Standard Deviation and Standard error of Mean of Achievement of Students of Experimental and Control Groups in Environment



From the table 4.1 and Figure 4.1 it was found that the Mean achievement of students in Environment of experimental group and control group were 78.45 and 58.82 respectively. The Standard Deviations from the Means for the achievement of students in Environment were found to be 3.75and 7.82 respectively for experimental

group and control group with Standard Error of Means of 0.82 and 1.71 for the respective groups. Comparing the Means it was found that the Mean of experimental group was higher than the control group. From the Standard Deviations and Standard Error of Means of both the groups it was also observed that the control group was quite more heterogeneous in terms of their achievement in Environment in comparison to their experimental counterpart. The higher mean achievement score of experimental group in Environment in comparison to the control group may be due to the effect of the developed cartoon and comics based multimedia package. To find whether the difference in the mean was significant or by chance and to test the null hypothesis i.e. H_0, "There will be no significance difference between the mean post-test achievement scores of primary students in Environment studied Environment through cartoon and comics based multimedia package and traditional method", Mann-Whitney U-test was used as the sample was taken purposively. The summary of the Mann-Whitney U-test is given in table 4.2, which is followed by analysis.

Table 4.2: Summary of Mann-Whitney U-test for Environment Achievement of Experimental and Control group students with the Number of Sample, Sum of Ranks, U-value, z-value and Probability

Students	N	Sum of Ranks	U-value	z-value	Probability (p)
Experimental Group	22	715	452	4.88	0.00003
Control Group	22	285			

From table 4.2 it was observed that the sum of ranks of experimental group and control group students in Environment achievement were 715 and 285 respectively with 22 students in each group. The U-value and z-value were found to be 452 and 4.88 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_o) of z, for z <= 4.88, the two tailed probability was found to be 0.00003 which was lesser than our decided significance level (α) i.e. 0.01. Hence the null hypothesis i.e. "There will be no significance difference between the mean post-test achievement scores of primary students in Environment studied Environment through cartoon and comics based multimedia package and traditional method," was rejected and it could be believed that experimental group and control group students differ stochastically (significantly) in terms of their achievement in Environment.

From table 4.1 it was also established that the mean achievement of experimental group when calculated from post achievement test in Environment was more than the mean achievement of control group in Environment that could be attributed to teaching Environment through the use of cartoon and comics based multimedia package. Hence it indicates that the developed cartoon and comics based multimedia package in teaching Environment was effective in enhancing student's achievement in comparison to traditional approach. Thus it can be concluded that the developed cartoon and comics based multimedia package was found to be significantly effective in terms of enhancing students' achievement in Environment in comparison to the traditional approach.

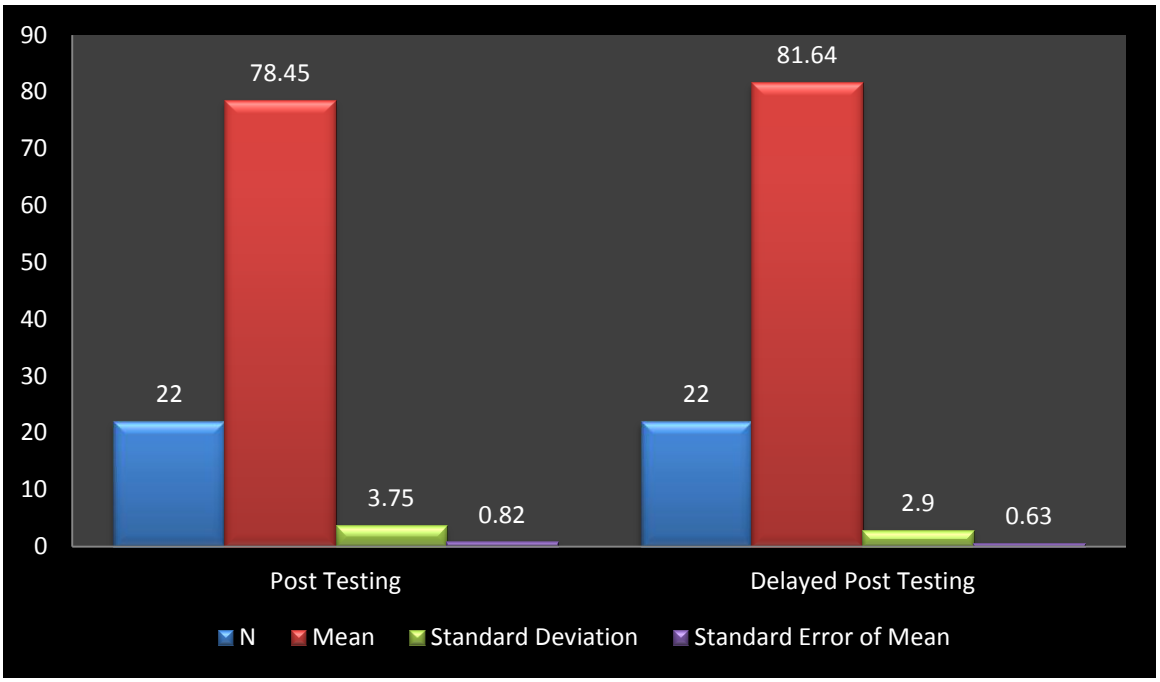
4.4.0 ACHIEVEMENT OF EXPERIMENTAL GROUP STUDENTS IN DELAYED TESTING IN ENVIRONMENT

To achieve the objective 3 of the present study i.e. `To study the delayed effect of developed cartoon and comics based multimedia package in terms of the achievement of the primary students in environment' and to test the null hypothesis 2 of the present study i.e. 'There will be no significance difference between the mean post-test achievement score and mean delayed post-test achievement score of primary students in Environment studied Environment using cartoon and comics based multimedia package', data were analyzed using Mean, Standard Deviation, Standard Error of Mean and Mann-Whitney U-test which is given and discussed in table 4.3 and table 4.4.

Table 4.3: Mean, Standard Deviation and Standard Error of Mean Wise Distribution of Delayed Achievement of Students of Experimental Group in Environment

Delayed Achievement in Environment	N	Mean	Standard Deviation	Standard Error of Mean
Post Testing	22	78.45	3.75	0.82
Delayed Post Testing	22	81.64	2.90	0.63

Figure 4.2: Graph showing Mean, Standard Deviation and Standard Error of Mean of Delayed Achievement of Students of Experimental Group in Environment



From the table 4.3 and figure 4.2 it was found that the Mean of post test and delayed post test achievement of students in Environment of experimental group were 78.45 and 81.64 respectively. The Standard Deviations from the Means for the achievement of students in Environment were found to be 3.75and 2.90 respectively of post test achievement and delayed post test achievement of experimental group with Standard Error of Means of 0.82 and 0.63 for the respective means. Comparing the Means, it was found that the Mean of delayed post test was higher than the post test of experimental group. From the Standard Deviations and Standard Error of Means of both the test it was also observed the group was found more homogeneous in the delayed post test achievement in comparison to their post test achievement. The standard error of mean of the delayed post test achievement was also found decreased. It showed a positive effect in the delayed achievement of experimental group that may be due to the long term memory effect of the teaching through the developed cartoon and comics based multimedia package. To find whether the difference in the mean was significant or by chance and to test the $H_0$2, Mann-Whitney U-test was used as the sample was taken purposively. The summary of the Mann-Whitney U-test is given in table 4.4, followed by analysis.

Table 4.4: Summary of Mann-Whitney U-test for Post-Test Achievement and Delayed Post-Test Achievement in Environment of Experimental Group Students, with the Number of sample, Sum of Ranks, U-value, z-value and Probability

Experimental Group	N	Sum of Ranks	U-value	z-value	Probability (p)
Post test Achievement	22	397	144	-2.30	0.0107
Delayed Post test Achievement	22	593			

From table 4.4 it was observed that the sum of ranks of experimental group in post test achievement in Environment and the delayed post test achievement in Environment were 397 and 593 respectively with 22 students in each group. The U-value and z-value were found to be 144 and -2.30 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_o) of z, for z <= -2.30, the two tailed probability was found to be 0.0107 which was slightly greater than our decided significance level (α) i.e. 0.01. Hence the null hypothesis i.e "There will be no significance difference between the mean post-test achievement score and mean delayed post-test achievement score of primary students in Environment studied Environment using cartoon and comics based multimedia package" was retained and it could be believed that the difference in the post test achievement in Environment and the delayed post test achievement in Environment of experimental group is by chance factor. Hence it indicates that the developed cartoon and comics based multimedia package in teaching Environment was not effective in enhancing student's achievement in delayed post test. Thus it can be concluded that the developed cartoon and comics based multimedia package was not found to be effective in terms of enhancing students' achievement in Environment in delayed achievement testing.

4.5.0 ACHIEVEMENT OF CONTROL GROUP STUDENTS IN DELAYED TESTING IN ENVIRONMENT

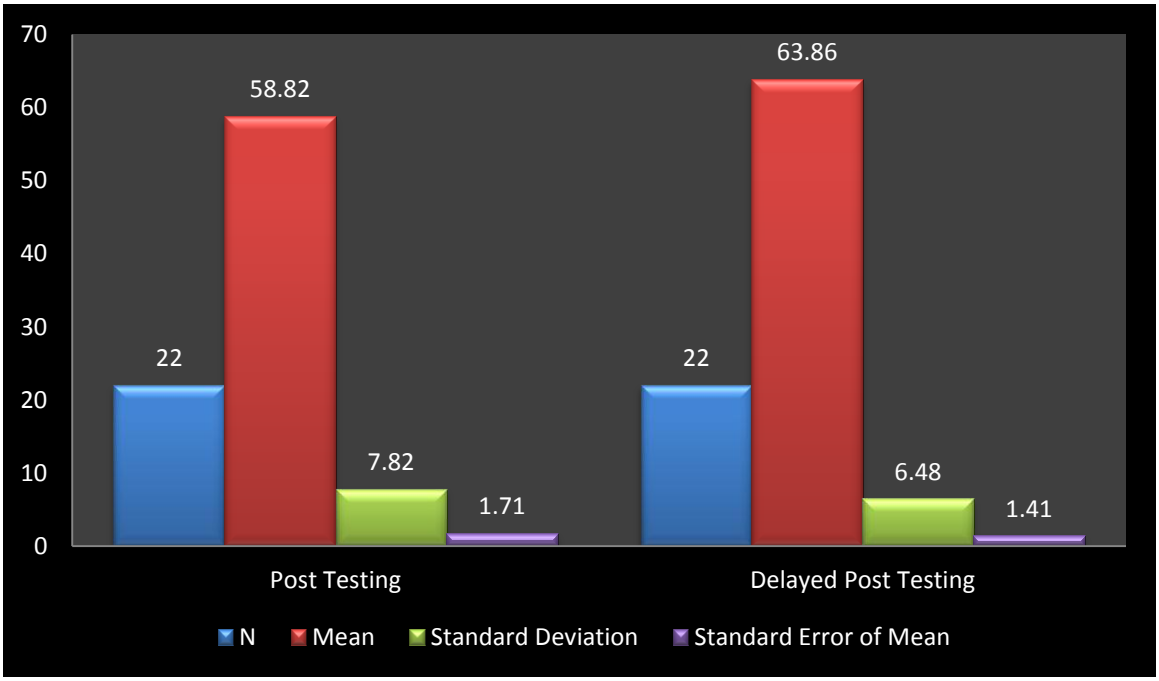
To achieve the objective 3 of the present study i.e. `To study the delayed effect of developed cartoon and comics based multimedia package in terms of the achievement of the primary students in environment' and to test the null hypothesis 3 of the present

study i.e. 'There will be no significance difference between the mean post-test achievement score and mean delayed post-test achievement score of primary students in Environment studied Environment through traditional method', data were analyzed using Mean, Standard Deviation, Standard Error of Mean and Mann-Whitney U-test which is given and discussed in table 4.5 and table 4.6.

Table 4.5: Mean, Standard Deviation and Standard Error of Mean Wise Distribution of Delayed Achievement of Students of Control Group in Environment

Delayed Achievement in Environment	N	Mean	Standard Deviation	Standard Error of Mean
Post Testing	22	58.82	7.82	1.71
Delayed Post Testing	22	63.86	6.48	1.41

Figure 4.3: Graph showing Mean, Standard Deviation and Standard Error of Mean of Delayed Achievement of Students of Control Group in Environment



From the table 4.5 and figure 4.3 it was found that the Mean of post test and delayed post test achievement of students in Environment of control group were 58.82 and 63.86 respectively. The Standard Deviations from the Means for the achievement of

students in Environment were found to be 7.82 and 6.48 respectively of post test achievement and delayed post test achievement of control group with Standard Error of Means of 1.71 and 1.41 for the respective means. Comparing the Means, it was found that the Mean of delayed post test was higher than the post test of control group. From the Standard Deviations and Standard Error of Means of both the test it was also observed the group was found more homogeneous in the delayed post test achievement in comparison to their post test achievement. The standard error of mean of the delayed post test achievement was also found decreased. It showed a positive effect in the delayed achievement of control group that may be due to the long term memory effect of the teaching through traditional method. To find whether the difference in the mean was significant or by chance and to test the $H_0$3, Mann-Whitney U-test was used as the sample was taken purposively. The summary of the Mann-Whitney U-test is given in table 4.6, followed by analysis.

Table 4.6: Summary of Mann-Whitney U-test for Post-Test Achievement and Delayed Post-Test Achievement in Environment of Control Group Students, with the Number of sample, Sum of Ranks, U-value, z-value and Probability

Control Group	N	Sum of Ranks	U-value	z-value	Probability (p)
Post test Achievement	22	399	146	-2.25	0.0122
Delayed Post test Achievement	22	591			

From table 4.6 it was observed that the sum of ranks of control group in post test achievement in Environment and the delayed post test achievement in Environment were 399 and 591 respectively with 22 students in each group. The U-value and z-value were found to be 146 and -2.25 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_o) of z, for z <= -2.25, the two tailed probability was found to be 0.0122 which was slightly greater than our decided significance level (α) i.e. 0.01. Hence the null hypothesis i.e "There will be no significance difference between the mean post-test achievement score and mean delayed post-test achievement score of primary students in Environment studied Environment through traditional method" was retained and it could be believed that

the difference in the post test achievement in Environment and the delayed post test achievement in Environment of control group is by chance factor. Hence it also indicates that the traditional method of teaching Environment was not effective in enhancing student's achievement in delayed post test. Thus it can be concluded that like the developed cartoon and comics based multimedia package, the traditional method was also not found to be effective in terms of enhancing students' achievement in Environment in delayed achievement testing.

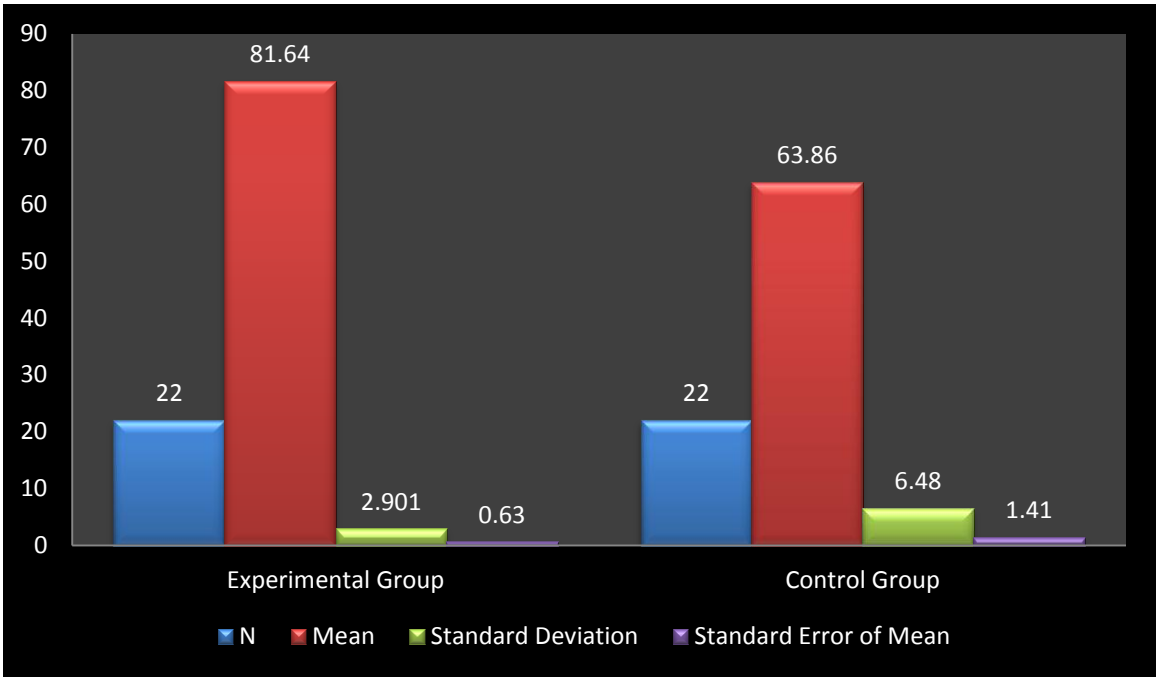
4.6.0 ACHIEVEMENT OF EXPERIMENTAL AND CONTROL GROUP STUDENTS IN DELAYED TESTING IN ENVIRONMENT

To achieve the objective 3 of the present study i.e. `To study the delayed effect of developed cartoon and comics based multimedia package in terms of the achievement of the primary students in environment' and to test the null hypothesis 4 of the present study i.e. 'There will be no significance difference between the mean delayed post-test achievement scores in Environment of primary students studied Environment using Cartoon and Comics Based multimedia package and Traditional method', data were analyzed using Mean, Standard Deviation, Standard Error of Mean and Mann-Whitney U-test which is given and discussed in table 4.7 and table 4.8.

Table 4.7: Mean, Standard Deviation and Standard Error of Mean Wise Distribution of Delayed Achievement of Students of Experimental and Control Group in Environment

Delayed Achievement in Environment	N	Mean	Standard Deviation	Standard Error of Mean
Experimental Group	22	81.64	2.901	0.63
Control Group	22	63.86	6.48	1.41

Figure 4.4: Graph showing Mean, Standard Deviation and Standard Error of Mean of Delayed Achievement of Students of Experimental and Control Group in Environment



From the table 4.7 and figure 4.4 it was found that the Mean of delayed achievement of students in Environment of experimental group and control group were 81.64 and 63.86 respectively. The Standard Deviations from the Means of the delayed achievement of students in Environment were found to be 2.901 and 6.48 respectively for experimental group and control group respectively with Standard Error of Means of 0.63 and 1.41 for the respective groups. Comparing the delayed means it was found that the delayed mean of experimental group was quite higher than the delayed mean of the control group. From the standard deviations and standard error of means of both the groups it was also observed that the control group was more heterogeneous in terms of their delayed achievement in Environment in comparison to the experimental group. To find whether the difference in the delayed mean achievement was significant or by chance and to test the $H_0$4, Mann-Whitney U-test was used as the sample was taken purposively. The summary of the Mann-Whitney U-test is given in table 4.8, followed by analysis.

Table 4.8: Summary of Mann-Whitney U-test for Delayed Achievement in Environment of Experimental and Control group Students, with the Number of sample, Sum of Ranks, U-value, z-value and Probability

Delayed Achievement of Students	N	Sum of Ranks	U-value	z-value	Probability (p)
Experimental Group	22	728	9	-5.47	< 0.00003
Control Group	22	262			

From table 4.8 it was observed that the Sum of Ranks of experimental group and control group scores were 728 and 262 respectively with 22 and 22 students in respective groups. The U-value and z-value were found to be 9 and -5.47 respectively. Referring Table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_o) of z, for $z \leq$ - 5.47, the two tailed probability was found to be <0.00003 which is quite less than our decided significance level (α) i.e. 0.01. Hence the null hypothesis i.e. 'There will be no significance difference between the mean delayed post-test achievement scores in Environment of primary students studied Environment using Cartoon and Comics Based multimedia package and Traditional method' is rejected and it can be said that the mean delayed post-test achievement score of experimental group in environment is stochastically (significantly) higher than the same of the control group which was due to the use of cartoon and comics based multimedia package by the experimental group. Hence, it can be said that the said cartoon and comics based multimedia package was found to be effective in terms of enhancing the delayed achievement of standard III students in Environment.

4.7.0 EFFECTIVENESS OF CARTOON AND COMICS BASED MULTIMEDIA PACKAGE IN TERMS OF STUDENTS' REACTION AND FEELINGS

The reaction and feelings of the students towards the cartoon and comics based multimedia package were collected with the help of discussion with the students after the implementation of the package. During the discussion few questions were asked to the groups like, Did you liked the cartoon characters?, how did you like the teaching through this package ?, was it interesting while learning through this package ?, did

you participate in the process of learning ? etc. and the students were asked to rise their hands in support of this. Parents were also known about this experiment. Parents were requested to discuss about the package with their child and give their reaction in written. Apart from this students were also observed by the researcher to know their reaction and feelings. Followings are few reactions and feelings of the students about the cartoon and comics based multimedia package that was used to teach them environment.

- Students were very much interested to learn environment with this package.
- Students were less resistant to learning during this period.
- Most of them liked teaching of Environment with the help of this package.
- Most of them liked the cartoon characters present in the multimedia package.
- Most of the students were ready to participate during the delivery of the lessons.
- They were always ready to continue the lesson of Environment even after completion of the specific period.
- The classes were found to be highly disciplined.
- They were found eagerly waiting for the Environment class.
- Many a times they asked the teacher to repeat the same lesson again and again.
- They were never found bored in the Environment classes while learning through this package.
- They were highly curious to know about the contents and were asked several questions during the classes of Environments.
- It was found that they continuously observed the full video of the lesson.
- Most of them said that they talked about their experiences of this teaching with their friends, teachers and even with their parents.
- Parents had also given their positive reactions towards this teaching learning process in written form. According to them their wards were very happy to learn through this package and even most of the concepts in Environment were very clear to them.
- They were found very expressive in feelings while watching the package, especially when it comes to happiness, sadness or sorrow and comedy.
- Students were found helping each other in solving problems while learning through multimedia package.

- The students were found very quickly completing the exercise given in the text book while learning through multimedia package.

The said reactions and feelings of the students about the teaching learning of Environment through this cartoon and comics based multimedia package showed the effectiveness of this package.

4.8.0 MAJOR FINDIGNS

Following major findings were drawn for the present study on the basis of the analysis and interpretation of the data.

1. The developed cartoon and comics based multimedia package was found to be significantly effective in terms of enhancing achievement of standard III students in Environment in comparison to the traditional method of teaching.
2. The developed cartoon and comics based multimedia package was not found to be significantly effective in terms of enhancing delayed achievement of standard III students in Environment studied through this multimedia package.
3. The developed cartoon and comics based multimedia package was found to be significantly effective in terms of enhancing delayed achievement of standard III students in Environment those studied through this package in comparison to the delayed achievement of standard III students studied environment through traditional method of teaching.
4. The developed cartoon and comics based multimedia package to teach Environment to standard III students was also found to be effective in terms of the reaction and feelings of students towards the package.

4.9.0 DISCUSSION AND CONCLUSION

Cartoons and comics are considered as one of the most powerful mode of communication for the people of all ages, particularly the young people and viewers may be for entertainment or for education purposes. Attempts had been made to use this mode in teaching learning process. With the invention of new information and communication technologies, the cartoon and comic mode had enhanced its efficiency

and popularity mainly in entertainment sectors. Considering the benefit of this medium, and the need for the joyful learning for young learners, attempts had been made to use this mode of communication in the field of teaching learning. In the present study attempt is made to prepare multimedia package using the Cartoon and Comics as a medium of presentation for teaching Environment to Standard III students. The major findings of the present study states that the developed cartoon and comics based multimedia package was found to be significantly effective in terms of enhancing achievement and delayed achievement of standard III students in Environment in comparison to the traditional method of teaching and the developed cartoon and comics based multimedia package to teach Environment was also found to be effective in terms of the reaction and feelings of students towards the package.

Findings of the study conducted by Parsons and Smith (1993), Wolschke and Groning (1994), Fisch et al. (1997), Witkowski (1997), Rollnick et al. (1997), Keogh and Naylor (1999), Kaptan (2001), Beard and Rhodes (2002), Rota and Izquierdo (2003), Jones (2004), Liu (2004), Kabapinar (2005), Perales et al. (2005), Gonzalez and Palacios (2006), Cheesman (2006), Dalacosta et al. (2008), Muniran and Yusof (2008), Olson (2008), Song (2008), Micheal and Van (2011), Mohammad (2011) and Jee et al. (2012) supports the findings of the present study that cartoon and comics can be used as a medium to enhance the achievement of students in different subjects. The findings of the present study shows that systematically designed technology-mediated instructional strategies can positively affect performance and learning of the students.

The findings of the present study show that the developed cartoon and comics based multimedia package was more effective than the traditional method of teaching in terms of achievement and delayed achievement of students in Environment. Reasons can be associated to some of the common known facts that the teaching through traditional method adopted in a classroom teaching does makes the student more a passive learner and does not take care of inclusion of more sensory and joyful activities of the students in comparison to that of cartoon and comics based multimedia package. The students are compelled to be the recipients of whatever the teacher teaches to them in the class, notwithstanding their interest as against the developed multimedia package that has cartoon and comics based images and

structures representations that can be associated to life like situations. Moreover, the student's experiences, imagination strength and understanding level might have assisted in relating the learnt things with diverse situation. Cartoon and comics based Multimedia package allowed the students to be recipient of the information of their interest and at their pace that might have assisted in better learning. Thus the overall effect of cartoon and comics based multimedia package in comparison to traditional method was found to be more effective.

As far as the reactions and feelings of the students were concerned it was found positive and favourable towards the multimedia package. Change is the spice of life and so one of the reasons behind positive and favourable reaction may be the change adopted in teaching–learning process itself, and the additive reasons may be the incorporation of cartoon and comics and structures, animation effects to cartoon and comics, the background effect, the clarity of explanation, the relevance and importance of the exposed images and content through multimedia package in their lives, utility of the learnt topics in life, freedom of learning through the multimedia package etc. The researcher opines that the students of this level like the cartoon and comics based animation and pictures which might have developed their liking for the developed cartoon and comics based multimedia package. The present study was a humble attempt to explore the potential of an entertainment medium of cartoon and comics in the field of education and learning considering the techno- pedagogic principles of teaching and learning. On the basis of the findings of the present study, it can be concluded that the medium has the potential to provide a platform for joyful learning to the primary school students. With the advent of more and more new technologies and considering the magic effect of cartoon and comics, the medium has huge scope for future in the potential areas like, universalization of elementary education, problems of drop out, preparation of quality teaching learning materials for little learners and above and all to enhance the quality of elementary education in the country. Sky is the limit and there is a strong need to utilize the benefits of this medium with the help of a strong research base.