CHAPTER 6
CONCLUSIONS AND SUGGESTIONS

6.0. THE STUDY IN RETROSPECT

The study analyzed the effectiveness of Web Based Instruction on the various scientific process skills namely reporting, interpretation, reasoning and problem solving skills among higher secondary students. The content of the Web Based Instruction package prepared was based on the syllabus prescribed by the university where the study was conducted. A website, www.pypp4phy.com, was created for the same; links and videos were created and were provided in each chapter for further reading and information on the topic being discussed in each. This enables students and the teachers to delve deeper into the subject during instruction and the contents sent to students through the www.edmodo.com platform enables them to have a self study and self evaluation.

In contrast to Computer Assisted Instruction, which has a tutorial program ensures the mastery of a topic; the Web Based Instruction used in the study aims at providing larger amounts of information and develops scientific skills through investigating about the topic by the students themselves with the help of the website.
6.1. OBJECTIVES OF THE STUDY

Objectives of the present study were:

1. To evaluate the gain scores of the reporting and interpretation skills among students.

2. To determine the effectiveness of Web Based Instruction package for developing reporting and interpretation skills among students.

3. To examine the gain scores of the reasoning and problem solving skills among students.

4. To determine the effectiveness of Web Based Instruction for developing reasoning and problem solving skills among the students.

5. To examine difference in the gain scores of the scientific skills among students.

6. To infer whether Web Based Instruction package is effective for developing Scientific Skills among students.

6.2. HYPOTHESES OF THE STUDY

1. There is a significant difference in the pretest mean scores of Reporting and Interpretation Skill among students.
2. There exists a significant difference between the post test mean scores in the Reporting and Interpretation Skill after the implementation of web Based Instructional strategy.

3. There exists a significant difference in the gain scores of the Reporting and Interpretation Skill among students.

4. Web Based Instruction package is effective for developing Reporting and Interpretation Skill among the Higher Secondary Students.

5. There is a significant difference in the pretest mean scores of Reasoning and Problem solving Skill among students.

6. There exists a significant difference between the post test mean scores in the Reasoning and Problem Solving Skill after the implementation of Web Based Instructional Strategy.

7. There exists a significant difference in the gain scores of the Reasoning and Problem solving skill among students.

8. Web Based Instruction package is effective for developing Reasoning and Problem Solving ability among the higher secondary students.

6.3. METHODOLOGY IN BRIEF

The investigator is a teacher in the University and gained permission from the university to conduct her research study on using Web Based Instruction in enhancing the scientific skills among the higher secondary students. Consequently, a class for two hours every day during the course of the semester was scheduled.
Quasi Experimental method was used for the study. To assess the effectiveness of Web Based Instruction on the scientific skills of higher secondary students, the students were administered the Web Based Instruction Package. A pre-test post-test two group design was used. The sample for the experimental study comprised of 228 students from Princess Nora University, Riyadh, KSA (Experimental group – 114, Control Group - 114). The selection of samples was based on the selection criteria by the university, where students are evenly distributed in the classes based on their respective levels. The numbers in the experimental and control group were made even by random elimination method. The students were observed for a semester and were graded based on their midterm examination, quizzes conducted in the class, their self study materials (projects) and the practical laboratory works. The achievements of the Experimental And Control Group were compared.

The criterion referenced tests were prepared by the investigator in consultation with the experts of the university and consequently their approval. For the course, each class is provided with an e-podium with an internet connection. The web based instruction material was presented to the students and was prepared based on the syllabus of the prescribed course.

The various skills evaluated were

1. Reasoning skill (based on their syllabus prescribed).

2. Problem solving skill (based on the problem sums in the syllabus prescribed).

3. Interpretative skill (based on their project work and the syllabus prescribed).
4. Reporting skill (based on their project work).

More weightage was given to the Reasoning and Problem solving skill from their class work, quizzes, homework and classroom evaluation. Reporting and interpretation skill was evaluated mainly from their Practical sessions, practical examination and the project work prepared by them.

6.3.1. Preparation of the Package:

Each topic was taken and brief explanation of the concept was along with the definitions, equations and derivations if necessary were made. These were uploaded in the form of pdf and slides in the website. In addition, videos in relation to each chapter and needed definitions were also created and uploaded by the investigator. The edmodo website provided the platform for the instructor to keep in constant touch with the students both within and outside the campus. Opening the website www.pypp4phy.com, itself provides the user with all the available resources being used for the delivery of content and communication.

6.4. CONCLUSIONS BASED ON FINDINGS

The conclusions based on the statistical analysis of the test scores are classified under following heads.

Conclusion 1: Two groups (Control Group and Experimental Group) do not differ significantly in their pre test scores based on the Reporting and Interpretational Skills the above conclusion is arrived at on the basis of the following major findings.
The critical ratio obtained is 1.41 it is less than the table value 1.96, at 0.05 level significance. This shows that there is no significant difference between the means of the pre-test scores of students in the experimental group and control group.

**Conclusion 2:** The two Groups namely Experimental and Control Group show a significant difference in their post test scores based on the Reporting and Interpretation Skills. The above conclusion is arrived at on the basis of the following major findings.

The mean scores of the experimental group 31.53 is greater than that of the control group 23.78. The critical ratio obtained is 12.66, which is highly significant at 0.01 level, the table value being 2.58, at df 228. Since the mean of experimental group is greater than that of the control group.

**Conclusion 3:** The two Groups namely Experimental and Control Group show a significant difference in their means of the gain scores, based on the Reporting and Interpretation Skills. The above conclusion is arrived at on the basis of the following major findings. The obtained critical ratio is 10.05, which is greater than 2.58 at .01 level. So it is significant at .01 level. It means that the difference between the means of the gain scores of the students in the experimental and control group is significant at .01 level (C.R=10.05; p<.01). From this it is clear that the students of the two groups differ significantly.

**Conclusion 4:** The two Groups namely Experimental and Control Group show a significant difference in their total effectiveness of Web Based Instructional strategies for developing
Reporting And Interpretation Skills. The above conclusion is arrived at on the basis of the following major findings:

The obtained $F_y 160.42$ is highly significant at 0.01 level ($F_y = 160.42; p < 0.01$). Since in the F test applied to the final $y$ scores $F_y$ falls beyond the 0.01 level of significance, it can be tentatively interpreted that Experimental Group is better than the Control Group.

And.. the table value of F ratio for df 1/225 is 7.01 at 0.01 level, the obtained $F_{y,x} 156.67$ is highly significant ($F_{y,x} = 156.67; p < 0.01$). Moreover, the adjusted $y$ means for post-test scores were tested for significance for df 1/67. The calculated $t$ value is 12.57 and the table value for significance for df 226 is 2.66 at 0.01 level. So the obtained $t$ value is significant at 0.01 level ($t = 12.57; p < 0.01$). The significant difference between the adjusted $y$ means indicates that the pupils of the Control And Experimental Groups differ significantly in their achievement in physics.

6.5. TENABILITY OF HYPOTHESES

Based on the findings the tenability of hypotheses set for the study were examined and the details are given as follows.

**Hypothesis 1**

*There is a significant difference in the pretest mean scores of Reporting and Interpretation Skill among students.*
The critical ratio obtained is 1.41 it is less than the table value 1.96, at 0.05 level significance. So the hypothesis, there exist a significant difference between the means of the pre-test scores of students in the Experimental Group and Control Group is rejected.

**Hypothesis 2**

*There exists a significant difference between the post test mean scores in the Reporting and Interpretation Skill after the implementation of web Based Instructional strategy.*

The critical ratio obtained is 12.66, it is greater than the table value  2.58, at df 228. Hence, the hypothesis 2 that there exists a significant difference between the post test mean scores in the Reporting and Interpretation Skill after the implementation of web Based Instructional strategy is accepted.

**Hypothesis 3**

*There exists a significant difference in the gain scores of the Reporting and Interpretation Skill among students.*

The obtained critical ratio is 10.05, which is greater than 2.58 at .01 level. So, the hypothesis, there exists a significant difference in the gain scores of the Reporting and Interpretation Skill among students is accepted.

**Hypothesis 4**

*Web Based Instruction package is effective for developing Reporting and Interpretation Skill among the Higher Secondary Students.*
The obtained \( F_y = 160.42 \) is highly significant at 0.01 level (\( F_y = 160.42; p < 0.01 \)). The obtained \( F_{y,x} = 156.67 \) is also highly significant (\( F_{y,x} = 156.67; p < 0.01 \)), and the obtained \( t \) value is significant at 0.01 level (\( t = 12.57; p < 0.01 \)). So, the hypothesis Web Based Instruction package is effective for developing Reporting and Interpretation Skill among the higher secondary students, is accepted.

**Hypothesis 5.**

*There is a significant difference in the pretest mean scores of Reasoning and Problem solving Skill among students.*

The difference between the mean scores of the two groups was tested for significance by finding the critical ratio.

The critical ratio obtained is .9823 which is not significant at 0.05 level, the table value being 1.96 with \( df \) 228. This shows that there is no significant difference between the means of the pre-test scores of pupils in the experimental group and control group. Therefore the two groups do not differ significantly in their performance. So it is inferred that before the experiment the two groups were more or less of the same ability. Hence Hypothesis 5 is rejected.

**Hypothesis 6.**

*There exists a significant difference between the post test mean scores in the Reasoning and Problem Solving Skill after the implementation of Web Based Instructional Strategy.*
The difference between the mean scores of the two groups was tested for significance by finding the critical ratio. The mean scores of the Experimental Group (24.75) is greater than that of the Control Group (21.18). The critical ratio obtained is 8.84, which is highly significant at 0.01 level, the table value being 2.58, at \( df \) 228. Since the mean of Experimental Group is greater than that of the Control Group, it is inferred that Experimental Group is better than the Control Group after the implementation of Web Based Instructional Strategy. Hypothesis 6 is hence accepted.

**Hypothesis 7**

*There exists a significant difference in the gain scores of the Reasoning and Problem solving skill among students.*

The difference between the pre test and post test scores of the students the Control Group and Experimental Group is prepared and the mean and standard deviation are calculated to find out the significance of difference between the means of gain scores.

It was found that the obtained critical ratio is 12.29, which is greater than 2.58 at .01 level. So it is significant at .01 level. It means that the difference between the means of the gain scores of the students in the Experimental And Control Group is significant at .01 level (C.R=12.29; \( p<.01 \)). From this it is clear that the students of the two groups differ significantly in their achievement in Scientific Skills in Physics. The significantly higher value of the mean of the gain scores of the students in the Experimental Group than that of the students in the Control Group indicate that the students in the Experimental Group excel
in comparison to the students in the Control Group in their achievement in Scientific Skills in Physics after the implementation of Web Based Instructional Strategy. Hence, Hypothesis 7 is accepted.

**Hypothesis 8**

*Web Based Instruction package is effective for developing Reasoning and Problem Solving ability among the higher secondary students.*

The pre-test and post-test scores of pupils in the control group and experimental group under the skills of reasoning and problem solving were subjected to Analysis of Covariance technique to determine whether there is any difference in the effectiveness of these two approaches. The total sum of squares, mean squares variance and F ratio were calculated for the pre-test and post-test score of the two groups.

The F ratio for the two sets of scores was tested for significance. The table value of F for df 1/226 is 3.84 at 0.05 level. So the obtained $F_{x=.964}$ is not significant at 0.05 level ($F_x = .964; p > 0.05$). Since the F test applied to the initial(x) scores fall for short of significance at 0.05 level, it is clear that the x means do not differ significantly.

The table value of F- ratio for df 1/226 is 6.63 at 0.01 level. So the obtained $F_y$ 78.27 is highly significant ($F_y = 78.27; p < 0.01$). The final y scores were corrected for differences in initial(x) scores. For that $SS_y$ have been adjusted for any variability in and the F ratio $F_{y,x}$ was calculated. The summary of ANCOVA is given in the following table.
The obtained $F_{y,x} = 76.73$ was tested for significance. Since the table value of F-ratio for $1/226$ is 7.01 at 0.01 levels, the obtained $F_{y,x}$ is greater than the table value. So $F_{y,x}$ is highly significant at 0.01 level ($F_{y,x} = 76.73; p < 0.01$).

The adjusted means of post-test scores ($y$ means) of pupils in the control and experimental groups were computed. The difference between the adjusted $y$ means was tested for significance.

The obtained $t$ value is 8.77 and it is greater than the table value 2.66 at 0.01 level. So the obtained ‘$t$’ value is highly significant at 0.01 level ($t = 8.77; p < 0.01$). Therefore, it can be tentatively interpreted that there is significant difference between the control and experimental groups in achievement and the experimental group performed better than the control group, hence hypothesis 8 is accepted.

**6.6. EDUCATIONAL IMPLICATIONS.**

The present study was concluded in such a way Web Based Instruction is effective in developing the various Scientific Skills among students. Based on the findings the following suggestions are made would be helpful for improving educational practices.

1. Workshops and seminars are to be organized for teachers to get a clear-cut idea about the use and implementation of web Based Instruction.

2. The software should be implemented in all the subjects and should be used by all teachers from the secondary level.
1. Web Based Instruction can help students develop their cognitive process in a systematic, analytical and logical manner.

4. The school curriculum and curriculum for teacher training should include provisions and activities that may enrich the knowledge about web Based Instruction.

5. Teachers attitude must be changed with respect to the use of new instructional strategies.

Moreover, it is very helpful for teacher educators, lecturers, educational administrators, ministry of higher education, and all the other departments related to education and curriculum development and curriculum experts for using this as a foundation for further improvement and excellence in their respective fields.

6.7. SUGGESTIONS FOR FURTHER STUDY.

This study gives an insight about Web Based Instruction so as to bring the best in the students. It is hoped that study would open doors for better implementation of online instructional strategies and hence aid in the development of Scientific Skills among students despite restrictions and social taboos. Some possible areas for further research are listed below.

- The present study can be further widened with getting more samples so as to generalize the findings to the whole kingdom or gulf countries.
• A survey can be conducted to find out the attitude of students towards the implementation of technology in teaching.

• The study can also be conducted among secondary and elementary levels using their curriculum to develop their aptitude and attitude towards science subjects.

• Yet another study can be conducted to determine how the Meta cognitive abilities of students develop using the Web Based Instructional Strategy.

• Other science process skills, reasoning skills and critical thinking skills can be studied in addition to the ones used in this study.

6.8. CONCLUSIONS

Web Based Instructional strategy is an effective teaching strategy. This provides opportunities for students to delve deeper into the subject either by themselves or with the help of their teacher and also to brush up and clarify the material learnt earlier. Through this students can develop their higher order thinking skills and Meta cognitive abilities. This aid is more effective to develop the higher order thinking skills of the children. It also helps a new teacher who is not familiar with the local language of the students. When the interpersonal relation between students and the teachers are very less and yet students have a burning desire to delve deeper into the subject, this strategy comes to aid.

The study was indeed helpful in developing the scientific skills among students and to an extent, the interpersonal relationship between the students and the teacher investigator.