CHAPTER – 5
SUMMARY AND CONCLUSION

5.1 Introduction

This chapter is intended to present a brief summary of the procedure adopted and the conclusion and suggestion derived from this study. The summary of the procedure adopted is followed by a short description of the major findings of the study. The chapter includes the study in retrospect, objectives of the study, hypothesis formulated or the study, methodology in brief, major findings of the study, discussion and conclusion, educational implications, recommendations and suggestions for the further research.

5.2 Study in Retrospect

Study in retrospect gives the summary of the study by giving details about the objectives, hypotheses and methodology.

Objectives of the Study

1. To find out the level of scientific attitude and achievement in science of the secondary school tribal students of class VIII.
2. To determine the relationship between science process skills, scientific attitude and achievement in science among secondary school tribal students
3. To construct a module in experiential pedagogy in science at secondary school level for the tribal students.
4. To determine the effect of experiential pedagogy on the science process skills, scientific attitude and achievement in science of the secondary school tribal students
5. To find out if there exist any significant difference in the "post-test" and the delayed "post-test" in science process skills, scientific attitude and achievement in science in secondary school tribal students.
6. To classify the different types of learners according to Kolb's Experiential Learning Style and to find out the significant difference in the effectiveness of Experiential Learning module on their science process skills, scientific attitude and achievement in science of the secondary school tribal students based on their learning style.

Hypotheses formulated for the Study

1. There exists no distinct different level of scientific attitude and achievement in science among secondary school tribal students.
2. There exists no correlation between the science process skills, scientific attitude and achievement in science of secondary school tribal students.
3. Experiential pedagogy has no significant effect in increasing the science process skills, scientific attitude and achievement in science of the secondary school tribal students.
4. There exists no significant difference in the "post-test" and the delayed post-test in science process skills, scientific attitude and achievement in science in secondary school tribal students.
5. There exists no distinct and different types of learners based on learning styles.
6. There exists no significant difference in science process skills, scientific attitude and achievement in science of secondary school tribal students based on their learning style.

Methodology in Brief

Method

The method adopted for the study was experimental research. In the first phase a pilot study was administered on a random sample of 50 tribal students. This was done so as to validate all the tools developed by the researcher. An experimental module was also constructed in the first phase and expert opinions were sought in order to validate the module.

In the second phase the data collection was carried out in the selected sample using the validated tools. This phase included "pre-testing", intervention using the validated experiential pedagogy module and "post-testing" of the selected sample. A delayed "post-test" was carried out to check the retention of the concepts taught. In the second phase a qualitative focus group interview schedule was also administered on the selected sample and the teachers to understand the effectiveness of the module developed.

Experimental Design

Single group "pre-test" "post-test" design

Sample and Population

The population for the study included the PVTG students studying in Class VIII of Asram schools in Kerala consisting of 160 students in 4 different Asram Schools in Kerala. From this, a sample of 80 students from 2 different Asram Schools in Kerala, respectively from Palakkad and Malappuram districts in Kerala were taken for the present study.

Variables included in the study

Dependent variables:

- Science Process Skills
- Scientific Attitude
- Achievement in Science

Independent Variable:

- Experiential Pedagogy

Extraneous variable:

Learning style

Tools used in the study

- Previous Knowledge Test in Science
- Achievement test in Science
- Science Process Skill Test
- Scientific Attitude Scale
- Kolb's learning style inventory KLSI Version 3.1
- Student opinionnaire on ELPSS
- Teacher opinionnaiare on ELPSS
- Reflection on ELPSS by the researcher
- Lesson transcripts on experiential learning

Experimental learning package used in the study

Experiential Learning Package in Sound and Static Electricity (ELPSS)

Statistical Techniques used in the study

- Measures of central tendency
- Measures of dispersion
- Karl Pearson's product moment correlation
- Independent sample t- test

- Paired sample t- test
- ANOVA

5.3. Major Findings of the Study

The following were the major findings of present investigation:

1. Descriptive analysis of the scores obtained for both "pre-test" and "post-test" for both the schools respectively Malampuzha and Nilambur were calculated for all the dependent variables. The measures of central tendency and dispersion of the Malampuzha School for the dependent variables were found out as (M=21.90 Md=22.0 Mo=22 SD= 4.46) for "pre-test" and (M=43.40 Md=43.41 Mo=44 SD= 5.46) for post-test for the variable "Achievement in Science". The measures of central tendency and dispersion of the Nilambur School for the dependent variable "Achievement in Science" was found to be (M=24.33 Md=23.00 Mo=23 SD= 4.96) for "pre-test" and (M=44.60 Md=44 Mo=46 SD= 6.95) for "post-test". The results showed that the data corresponds to a normal sample and the sample chosen is having the characteristics as prescribed in a normal distribution
2. The "Scientific Attitude" score when analysed yielded the scores (M=190.70, Md=187.0 Mo= 185 SD=14.92) for "pre-test" and (M=200.03, Md=200.0 Mo= 194 SD=12.97) for "post-test" for Malampuzha school and (M=207.73, Md=205.00 Mo= 199 SD=13.21) for "pre-test" and (M=220.85, Md=219.00 Mo= 219 SD=11.66) for "post-test" for Nilambur School students. It showed the normalcy of distribution for the variable "Scientific Attitude".
3. When the scores of "Science Process Skills" were analysed it was found that (M=20.25, Md=21.0 Mo= 21 SD=5.30) for "pre-test" and (M=32.95, Md=33.00 Mo= 33 SD=4.86) for "post-test" and for Malampuzha school students and for the scores of students of Nilambur it was (M=21.45, Md=21.00 Mo= 21 SD=3.87) for "pre-test" and (M=37.03, Md=37.00 Mo= 37 SD=4.31). The individual dimensions of science process skill Observation, Comparison, Classification, Measurement and Model making skills recorded a "pre-test" score of (M= 2.95, Md=3, Mo=3, SD=1.395), (M=5.425, Md=5.5, Mo=7, SD=1.767), (M=2.925, Md=3, Mo=3, SD=1.607), (M=4.15, Md=4, Mo=2,SD=2.095), (M=4.8, Md=5, Mo=5, SD=1.772) respectively and a "post-test" score of (M=5.675, Md=6, Mo=6, SD=1.591), (M= 7.95, Md=8, M0=8, SD=1.853), (M=5.5, Md= 5, Mo=4, SD=1.797), (M=6.325, Md=6, Mo=4, SD=1.927), (M=7.5 Md=7, M0=7,

SD=1.797) respectively in the Malampuzha Asram School. The individual dimensions of science process skill Observation, Comparison, Classification, Measurement and Model making skills recorded a "pre-test" score of (M= 3.825, Md=4, Mo=3, SD=1.647), (M=4.325, Md=4, Mo=6, SD=1.712), (M=3.375, Md=3, Mo=3, SD=1.705), (M=4.775, Md=5, Mo=5,SD=1.874), (M=5.15, Md=5, Mo=4, SD=2.713) respectively and a "post-test" score of (M=6.975, Md=7, Mo=9, SD=1.901), (M= 7.65, Md=8, Mo=8, SD=1.424), (M=6.025, Md= 6, Mo=5, SD=1.717), (M=7.825, Md=8, Mo=7, SD=1.647), (M=8.55, Md=9, Mo=9, SD=1.449) respectively in the Malampuzha Asram School. It can be seen from the descriptive statistics that the variable "Science Process Skill" also has a normal distribution of the sample and each of the dimensions in the "Science Process Skill" showed a normal distribution too.

4. The descriptive analysis results calculated the central tendency and the dispersion of the scores in Malampuzha and Nilambur schools for the two dependant variables "Scientific Attitude and Achievement in Science". Based on the analysis the different levels of achievement and attitude were found out. The sample was divided into high, average and low groups accordingly in "pre-test" and the "post-test". The "pre-test" and "post-test" in Malampuzha Asram School recorded (high =6, average =28, low =6) and (high =7, average =27, low ==6) respectively for "Achievement in Science". Similarly the "pre-test" and "post-test" recorded (high =6, average =27, low =7) and (high =5, average =28, low =7) respectively for "Scientific Attitude". In Nilambur IGMMRS Asram School, the pre and "post-test" recorded (high =7, average =27, low =6) and (high =7, average =27, low =6) respectively for "Achievement in Science". Similarly for "Scientific Attitude" the pre and "post-test" recorded (high =5, average =29, low =6) and (high =6, average =31, low =3) respectively. The interpretation can be thus recorded that there exists three different groups as high, average and low which corresponds to a data that is equivalent to a normal distribution sample. Majority of the sample population has an average score on both "Achievement in Science and Scientific Attitude".
5. The product moment correlation coefficient between the scores of "Achievement in Science and Scientific Attitude" of secondary school tribal students studying in Class VIII of Malampuzha Asram School were found out to be ($r=0.987$, $p<0.0001$) and is denoting highly positive correlation which is significant at 0.01

level of confidence. The product moment correlation coefficient between the scores of "Achievement in Science and Scientific Attitude" of secondary school tribal students studying in Class VIII of Nilambur Asram School were found out to be ($r=0.958$, $p<0.0001$) and is denoting highly positive correlation which is significant at 0.01 level of confidence. This indicated that the variables are highly correlated to each other and that an increase or positive variation in science achievement will make a corresponding increase in scientific attitude of the secondary school tribal students and vice versa. Hence it can be inferred that the correlation between scientific attitude and achievement in science is positive and is significant at 0.01 level of confidence.

6. The correlation coefficient between the scores of "Achievement in Science and the Science Process Skills" of secondary school tribal students studying in Cass VIII of Malampuzha Asram School and the Nilambur Asram School were found out as ($r=0.292$) and ($r=0.127$) which is positively correlated but not significant at the 0.01 level of confidence. The dimensions of "Science Process Skills" also showed a low value for correlation coefficient in both the Asram Schools. The dimension wise values for correlation coefficient 'r' in Malampuzha Asram School and Nilambur Asram School were found out as (observation =0.334, comparison =0.035, classification = -0.037, measuring = 0.229 and model making = 0.251) and (observation =-0.001, comparison =-0.139, classification = 0.476, measuring = -0.013 and model making = -0.034). Hence it can be inferred that the correlation between science achievement and total science process skills is positive but not significant. In Nilambur Asram School, the only dimension that showed a positive correlation coefficient was the classification skill. All the other dimensions showed considerably low and a negative correlation coefficient. Whereas in Malampuzha Asram School, the only dimension that showed a negative correlation was the classification skill and all the other dimensions showed a positive correlation coefficient. The dimension wise analysis of correlation showed no significance at all.

7. The correlation coefficient between the scores of "Scientific Attitude and the Science Process Skills" of secondary school tribal students studying in Cass VIII of Malampuzha Asram School and the Nilambur Asram School were found out as ($r=0.256$) and ($r=0.060$) which is positively correlated but not significant at the

0.01 level of confidence. The dimensions of "Science Process Skills" also showed a low value for correlation coefficient in both the Asram Schools. The dimension wise values for correlation coefficient 'r' in Malampuzha Asram School and Nilambur Asram School were found out as (observation =0.361, comparison =0.031, classification = -0.095, measuring = 0.21302 and model making = 0.207) and (observation =-0.094, comparison =-0.144, classification = 0.466, measuring = -0.053 and model making = -0.049). Hence, the correlation between "Scientific Attitude" and total "Science Process Skills" is also a positive one but no significance relationship is found out between the two. The dimension wise analysis of "Science Process Skills" showed a negative correlation coefficient except for the classification and measurement skill in Malampuzha Asram School but in Nilambur Asram School the classification skill alone showed a positive correlation and hence the dimension wise science process skills showed no significance at all.

8. It was seen that Experiential pedagogy has a significant effect on enhancing the academic "Achievement in Science, Scientific Attitude and the Science Process Skills" of the secondary school tribal students. The "pre-test" mean and standard deviation of the Malampuzha Asram School in "Achievement in Science" were recorded as (21.90, 4.460). Similarly the "post-test" mean and the standard deviation of the Malampuzha Asram School in "Achievement in Science" were recorded as (43.40, 5.462). It also showed a significant t value of 80.240 which shows that the experiential pedagogy has a significant effect in enhancing the "Achievement in Science" of the secondary school tribal students of Class VIII. The "post-test" mean and standard deviation scores are higher when compared with the "pre-test" scores.

9. The "pre-test" mean and standard deviation of the Nilambur Asram School in "Achievement in Science" were recorded as (24.33, 4.963). Similarly the "post-test" mean and the standard deviation of the Malampuzha Asram School in "Achievement in Science" were recorded as (44.60, 6.946). The "post-test" mean was higher when compared with the "pre-test" scores. It also showed a significant t value of 56.629 which shows that the experiential pedagogy has a significant effect

in increasing the achievement in science of the secondary school tribal students of Class VIII.

10. The "Scientific Attitude" scores of the "pre-test" (M=190.70, SD=14.19) and the "post-test" (M= 200.03, SD= 12.974) in Malampuzha Asram School also showed a significant t value of 18.537.
11. The "Scientific Attitude" scores of the "pre-test" (M=207.73, SD=13.206) and the "post-test" (M= 220.85, SD= 11.659) in Nilambur Asram School also showed a significant t value of 32.004. So it can be inferred that the package in experiential learning is effective in enhancing the scientific attitude of the sample in both schools.
12. The "Science Process Skill" value of the "pre-test" (M=20.250, SD= 5.299) and the "post-test" (M= 32.950, SD= 4.862) conducted among the Class VIII tribal students in Malampuzha Asram School showed a significant t value of 22.074. The dimensions of the science process sills were also analyzed individually and each of the dimensions selected Observation skill ("pre-test" M=2.950, SD=1.395) ("post-test" M=5.675, SD=1.591) had a t value of 15.873, Comparison skill ("pre-test" M=5.425, SD=1.767) ("post-test" M=7.950, SD=1.853) had a t value of 11.442, Classification skill ("pre-test" M=2.925, SD=1.607) ("post-test" M=5.500, SD=1.797) had a t value of 10.856, Measurement skill ("pre-test" M=4.150, SD=2.095) ("post-test" M=6.325, SD=1.927) had a t value of 10.002, Model making skill ("pre-test" M=4.800, SD=1.772) ("post-test" M=7.500, SD=1.797) had a t value of 15.021 also had significant difference between the "pre-test" and the "post-test". Hence it can be told that the package in experiential learning is effective in enhancing the science process skills of the students involved in the study.
13. The "Science Process Skill" value of the "pre-test" (M=21.45, SD= 3.869) and the "post-test" (M= 37.025, SD= 4.306) conducted among the Class VIII tribal students in Nilambur Asram School showed a significant t value of 25.374. The dimensions of the science process skills were also analyzed individually and each of the dimensions selected Observation skill ("pre-test" M=3.825, SD=1.647) ("post-test" M=6.975, SD=1.901) had a t value of t=12.136, Comparison skill ("pre-test" M=4.325, SD=1.716) ("post-test" M=7.650, SD=1.424) had a t value of

t=12.258, Classification skill ("pre-test" M=3.375, SD=1.705) ("post-test" M=6.025, SD=1.717) had a t value of t= 9.434, Measurement skill ("pre-test" M=4.775, SD=1.874) ("post-test" M=7.825, SD=1.647) had a t value of t=10.411, Model making skill ("pre-test" M=5.150, SD=2.713) ("post-test" M=8.550, SD=1.449) had a t value of t= 8.676, also had significant difference between the "pre-test" and the "post-test". It showed the effectiveness of the experiential pedagogy on the science process skills of the secondary school tribal students studying in Class VIII Asram schools of Kerala

14. Delayed "post-test" was administered on the sample in order to check the memory retention after the administration of the experiential learning package. It was conducted after two weeks since the completion of the "post-test" in the sample. The "Achievement in Science" in Malampuzha Asram School showed a significant t value 13.549 between "post-test" (M=43.40, SD=5.462) and the delayed "post-test" (34.90, SD=5.995). Similarly in Nilambur Asram School also there was a significant t value of t=10.491 between "post-test" (M=44.60, SD=6.946) and the delayed "post-test" (37.05, SD=5.791). This showed that the students that they are able to retain the concepts taught using the experiential pedagogy with a little less retention as the delayed test means are lesser than the "post-test" means.
15. The "Scientific Attitude" scores also showed a considerable progress in both the Asram schools. The t value found between the "post-test" and delayed "post-test" in MalampuzhaAsram School and the Nilambur Asram School was recorded as 15.004 and 9.760 for scientific attitude. The "post-test" (M=200.03, SD=12.974) and delayed "post-test" score (M=246.95, SD=20.554) in Malampuzha Asram School and the "post-test" (M=220.85, SD=11.659) and the delayed "post-test" (M=246.33, SD=17.320) in Nilambur Asram School also showed a considerable difference. It is thus found to be statistically significant and this shows the effectiveness of the experiential pedagogy in enhancing the scientific attitude of the sample. Despite the time gap for checking the retention of the variable in the sample, the results showed that experiential pedagogy has a significant effect in enhancing the variable, scientific attitude of the sample. The increase in the mean score of the delayed "post-test" suggests that the pedagogy was effective in enhancing the "Scientific Attitude" of the sample.

16. In Malampuzha Asram School, the "Science Process Skill" score total value (t=7.517) showed a significant t value for the "post-test" (M= 32.950, SD=4.862) and the delayed "post-test" (M=34.725, SD=4.332) whereas the two dimensions in science process skill didn't show a significant t value. The individual dimensions observation skill (t=5.448), classification skill (t=5.152) and measurement skill (t=2.876) showed a significant t value between "post-test" (M=5.675, SD=1.591), (M=5.500, SD=1.797), (M=6.325, SD=1.927) and the delayed "post-test" (6.225, SD=1.230), (M=6.175, SD=1.357), (M=6.675, SD=1.575) respectively. The other dimensions comparison skill (t=0.240) and model making skill (t=1.361) didn't show a significant t value between "post-test" (M=7.950, SD=1.853), (M=7.500, SD=1.797) and delayed "post-test" (M=7.975, SD=1.73), (M=7.675, SD=1.623) respectively. In Nilambur Asram School, the science process skill score total value (t=5.088) showed a significant t value between "post-test" (M=37.025, SD=4.306) and delayed "post-test" (M=38.300, SD=4.127) whereas the two dimensions in science process skill didn't show a significant t value. The individual dimensions observation skill (t=2.504), classification skill (t=3.356) showed a significant t value between "post-test" (M=6.975, SD=1.901), (M=6.025, SD=1.717) and the delayed "post-test" (M=7.275,SD=1.502), (M=6.575,Sd=1.412) respectively whereas the other dimensions comparison skill (t=0.552), measurement skill (t=1.125) and model making skill (t=1.125) didn't show a significant t value between "post-test" (M=7.650,SD=1.424), (M=7.825, SD=1.647), (M=8.550, SD=1.449) and delayed "post-test" (M=7.725, SD=1.176), (M=8.000, SD=1.502), (M=8.725, SD=1.449) respectively.
17. From the analysis carried out it was clear that there existed four different learning styles among the selected sample. In MalampuzhaAsram School, 50% belonged to the diverging learning style, 32% belonged to the accomodating learning style, 10% belonged to the assimilating learning style and the rest 8% belonged to the converging learning style. In Nilambur Asram School, 47% belonged to the diverging learning style, 25% belonged to the accomodating learning style, 15% to the assimilating learning style and the rest 13% belonged to the converging learning style.
18. In order to check the significant difference between the learning styles on the dependent variables, ANOVA was carried out and it was seen that the calculated

value of F of each of the mean scores of science process skills, scientific attitude and achievement in science is 0.110, 0.540 and 0.482 respectively which is lesser than the table value of F(3,36) which is 2.87at 0.05 level of significance for the Malampuzha Asram School. Similarly, it was seen that the calculated value of F of each of the mean scores of science process skills, scientific attitude and achievement in science is 0.310, 0.406 and 0.103 respectively which is lesser than the table value of F(3,36) which is 2.87at 0.05 level of significance for the Nilambur Asram School. It means that there exists no significant difference in the mean scores of achievement in science, science process skills and scientific attitude of the secondary school tribal student studying in Class VIII of Asram School Malampuzha and Nilambur based on their respective learning styles.

19. Focus group interviews were conducted on the effectiveness of ELPSS in teachers and students. Almost 80 percent of the students and 80 percent of the teachers were of the opinion that ELPSS was effective in enhancing the science process skills, scientific attitude and achievement in Science of secondary school tribal students studying in Asram schools of Kerala. Rest 20 percent f the students and teachers had mixed opinions like, more time should be given to complete the curriculum, more support staff and ample activities in each topic should be given which needs proper training and practice for effective implementation. Also the resources and materials required in doing the activities in ELPSS cannot be supplied as it needs a proper training for the identification and proper selection of them.
20. A qualitative reflection on the implementation of the experiential pedagogy through the researcher developed package ELPSS in the sample was done by the researcher which has provided a clear analysis on the activities given to the students, their participation and interest in the same. There were 7 open ended reflection questions prepared by the researcher for qualitatively analyzing the effectiveness of the ELPSS package instruction. They were analyzed and tabulated by the researcher based on the activity involvement of the students during the package administration. The time consuming activities, those activities that students lacked interest to participate and similar questions relating to the administration and implementation of ELPSS were identified and tabulated by the researcher.

5.4 Educational Implications of the Study

The study is based on experience based instruction as suggested by Kolb (1975). It follows the experiential pedagogy to instil in curiosity and scientific attitude among the chosen sample. The study elaborately studies the achievement progress made by a student who is following the experiential learning system. This will help the educationists to analyze the cognitive level progress made by the students through the administration of the chosen methodology. The study also helps to develop and enhance the basic science process skills and the scientific attitude of the students which are very important aspects of science teaching and learning. The findings of the study were thus helpful in enhancing the student attitude towards the teaching learning process. The methodology that has been followed in the study can help the future researchers and the educationists to choose an appropriate teaching methodology so as to arouse interest and curiosity among a culturally deprived population.

Hence it is high time that all of us educationists, entrepreneurs and social organizations join hands with the government to enhance the educational status of the tribal children and help them understand the importance of education and employment opportunities. Along with the scientific advancements, this point too needs to be focused that the country can develop only if the people living within the country are literate, employed and well sustained by themselves. Ample opportunities must be provided by the teachers themselves so that the education becomes an enjoyable process to the tribal children.

5.5 Recommendations of the Study

The study has explored the educational status of the four major PVTG tribal groups namely, 'Kurumbars', 'Kadars', 'Kattunayakans' and 'Cholanaickans'. The experiential learning has played a significant role in changing their achievement levels in the subject of study and has played a great role in enhancing the scientific attitude of the tribal students. Since the students belong to a community that is deeply deprived both culturally and economically, the study has made a considerable attempt in simplifying the methodology by choosing relevant learning experiences from their culture and local knowledge. The study puts forward a major recommendation that the educational instruction be changed to a suitable pedagogy like experiential learning that can bring an enjoyable learning experience to such a minority sample. The educational ostracism which is else prevalent among this social group can be widely narrowed down if such an appropriate instructional method of teaching learning is practiced in schools.

5.6 Suggestions for further Research

The study so far has attempted to enhance the student attitude towards science as a school subject. It is to be noted that the secondary school comprise of basic subjects that are essentially and inevitably needed for the lifelong learning of the child. It is important that the children get a basic knowledge of all the subjects at the end of their secondary school. So it can be a topic of research to examine the implementation and practice of experiential teaching learning practices in all the basic subjects of secondary school. The study tries to examine the 4 major PVTG tribal groups who are very much backward in their literacy and educational status. Other tribes can also be selected for further research and studies so that the educational status of all the notable tribes can also benefit from such a novel experience based learning platform. The study can be adapted to other subjects as well to imbibe in the principles of experiential learning to all the subjects of study at the secondary level. The study is well in tune with the principles of work based education as suggested by Mahatma Gandhi, our honourable Father of Nation and so the principle can be adapted in all learning and training methodologies for self sustainable education.

5.7 Conclusion

The study entitled the "Effectiveness of Experiential Pedagogy on Science Process Skills, Scientific Attitude and Achievement in Science of Secondary School Tribal Students in Kerala" has significant impact in enhancing the achievement in science, scientific attitude and the science process skills of the student with the help of an enjoyable learning experience provided to them by experiential learning module. They must be capable of solving practical problems through logic ad reasoning skills. Experiential pedagogy progresses through a learning cycle in which the learner finds himself in different stages of learning while a new learning is being acquired by him. A logical sequence follows behind each learning stage and when the learner unveils the sequence of logic by himself and a permanent learning happens in him. The learning hence becomes a cake walk for the learner as they become burden free from rote learning and memorising. Experiential learning can be adopted in all the schools and colleges irrespective of their age group and maturity level because the pedagogy progresses forward through the learner progress and convenience. It can initiate self learning and self sustainability among the learners and can set a beautiful stage for burden free hassle free learning experience.