CHAPTER - 7

CONCLUSION
&
CHAPTERIZATION
7.1.0 Conclusion

1. Post-test means of experimental and control group do not differ significantly as evident from ANOCOVA. Thus, the null hypothesis is true. \( F_{y,x} = 0.00026 \) is not significant at 0.01 level and at 0.05 level.

2. However, the objective-wise analysis of scores on formative tests and post-test shows that students taught by Constructivist approach have attained greater level of proficiency on higher level objectives such as application, process and skill as compared to the students taught by traditional method.

3. During the experimentation, the researcher observed that the students showed gradual development in the process of mental construction and the process became more sophisticated and clear. Students taught by Constructivist approach were also found satisfied with the interactive sessions held with them by the teacher.

4. Opinionnaire results showed that nearly 85% students had strongly favorable opinion towards Constructivist approach.
7.2.0 Implications of the study

1. Statistical analysis of the scores does not show any significant difference in the achievement of students of two groups viz. experimental group and control group. However, such result does not indicate overall failure of Constructivist approach to teaching. Construction is a continuous cognitive process and the conscious reflection of construction will certainly take time. Hence, this approach should be adopted as a regular strategy of teaching to expect the long-term results.

2. Constructivist theory assumes that the students construct knowledge on their own and that it is a process of organization of meaningful constructs. Thus, the unusual response to any question has its root cause in the process of construction and the very process has to be revised in order to eliminate the errors. This is useful for upgrading the students' performance in any subject.

3. Students with learning disabilities may be benefited if the Constructivist strategies are employed by the teacher. This is mainly attributed to the fact that the problems are usually at the cognitive level. The step by step analysis of students' response will help the teacher to discover the construction and thus to plan the remedial teaching.
4. Constructivist strategies can be effectively employed for the students with high intelligence levels. It is definitely interesting to probe the thinking process of such students. It will help the educators to plan the curricula suited to the needs of gifted children as well as to present them more challenging problems.

5. Constructivist approach will definitely prove effective for teaching Science and Mathematics at school level.

e.g. Given the lengths of sides of triangles and its height, the student can find its area by using the formula. In order to get the correct answer, the student must know the properties of triangle and the formula to calculate its area. In this process the errors may be perceptual, conceptual or computational. The teacher can talk to the student to find the error at any such level and help provide the remedy.

7.3.0 Suggestions

1. The researcher conducted the present study for one academic year. This period of time is very short to expect positive outcome of Constructivist approach in terms of achievement of the students. Hence, the teacher should internalize the Constructivist principles so that they can be incorporated into day-to-day teaching. This will facilitate more effective learning on students' part.
2. The teachers in elementary schools should be trained for employing Constructivist strategies so that the students will learn the basic mathematical concepts very well. It will help them to learn more complex topics in the years later.

3. It is observed that students usually show poor performance in the subjects such as Science, Mathematics and a foreign language like English. Constructivist Approach will be of a great help in improvising the students' performance in these subjects.

4. The present research was conducted on the sample of nearly 100 students in one school. The projects need to be undertaken on larger samples in different areas and at different levels of education.

5. Such projects should be conducted in collaboration with the schools and colleges. This will help to bridge the gap between educational research and its practice in teaching.

6. Teachers can be involved in research projects and training programmes. After all, they are the people who can assess the effectiveness of any teaching programme and inform the researchers regarding practical difficulties in implementation.

7. One of the noted works cited in chapter 2 is of Sharangpani (1990). He analysed the primary school curricula from Piagetian perspective and found overall mismatch. The curriculum designers have not taken into account the various stages of
cognitive development of children. Most of the topics included in the syllabi are dry and there is no scope to introduce them through play-way method. The exercises given to the children are mostly drill exercises and require merely computational skill. This is one of the possible reasons attributed to mediocre success of Constructivist approach implemented in the present study. The present day school curricula need to be revised thoroughly in the light of developmental stages of children and the content needs to be selected and organized in such a manner that the teacher can employ innovative strategies.

7.4.0 Chapterization

This module gives a brief summary of the chapters included in the thesis.

Chapter 1: Introduction

This chapter discusses importance of Mathematics, the current status of Mathematics teaching at school level, theories of teaching-learning Maths, the emergence of Constructivism and its meaning and the research in Constructivism in Mathematics teaching.

The place of Mathematics in education is clearly to be the central one. However, the present status of Mathematics teaching is far from satisfactory. As found by Sarangpani (1990), the teaching is dry, abstract and too ambitious. Besides, the curricula have not been designed according to the
There is no scope for freedom to learn and to introduce the play-way techniques.

There is a lot of research work being carried out in the field of education. But, the research done is not actually used for the development in education. Many researchers have tried out the prevalent theories of learning such as Piaget’s theory of cognitive development, Ausubel’s advance organizer, Bruner’s concept attainment model etc. Besides, different models of teaching such as mastery learning, programmed learning, guided discovery etc. have been used by the researchers. But all this is at individual level with the only objective to get degree. At the school level, there is not influence of modern trends in educational research on teaching. As said earlier, the Mathematics curricula are very rigid and not designed according to the stages of psychological development of children. The students have to learn the entire content thoroughly, even though, most of the topics are not relevant to day-to-day life. Thus situation leads to increasing number of failures in Mathematics.

Many researchers have tried to diagnose the causes of failure in Mathematics. Socio-economic status, sex, locality of the school are some of the factors that influence the students' performance in Mathematics, besides aptitude and intelligence level.

Constructivism is a relatively new trend in education although it has its roots in ancient philosophy as well as cognitive theories of learning (e.g. Piaget's theory of psychological development). Constructivism believes in
building powerful learning environment that requires suitable instructional settings. Learning is seen as a constructive act and the designer should provide for rich experiences by situating activities in authentic contexts and provide for exploration and sharing of multiple perspectives. The assumption of Constructivist approach is that a student uses his/her prior knowledge in mentally constructing new knowledge. However, it is different from discovery method in its unique approach to study the learning process.

For the present study, the researcher has employed the Constructivist approach to teaching Mathematics to Std VII students.

Chapter 2: Review of Related Research

The researcher referred to research work mainly done in the field of Mathematics teaching at middle school level. However the reference work was confined only to the implementation of various theories of learning and their effectiveness in teaching Mathematics. The major emphasis was laid on the works done in Constructivism and its implementation.

In India, there was no evidence of any work done in Constructivism. However, many researchers have studied the correlation between cognitive abilities and performance in Mathematics. The studies of Rawool S. (88), Sengupta (89), Kaul P. (92) are based on the same. According to Rawool, the students fail at understanding and application levels. Pandhari (88), found that language, memory and process affect the students' learning of Mathematics. Samuel F. (89) found that Piaget's stages of psychological development are observed to be followed by the children under Indian
conditions. Whereas Sarangpani (90) has stated that there is no correlation between the present Mathematics syllabi and the actual developmental stages of children. There is overall mismatch and teaching is dry and too ambitious.

The studies mentioned in Chapter 2 are based not only on Constructivism. However, they deal with the cognitive abilities of the students. Constructivism, too, deals with the student's learning at cognitive level. Hence, there is a close relationship between the cognitive approach in other theories and Constructivism. A lot of work has been done by the foreign universities and the individual researchers there. However, only the relevant studies have been quoted in Chapter 2.

Chapter 3: Methodology of the Study

1. The Research Design: The research design implemented for the present experimental research is non-randomized control group pre-test, post-test design. The paradigm for the design is as follows:

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<thead>
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<th></th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
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<tbody>
<tr>
<td>Experimental group</td>
<td>T₁, E</td>
<td>X</td>
<td>T₂, E</td>
</tr>
<tr>
<td>Control group</td>
<td>T₁, C</td>
<td></td>
<td>T₂, C</td>
</tr>
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</table>

The sample was comprised of 94 students from Std. VII studying in S.P.M. English Medium School, Pune. (Year 2002 - 2003)
2. **The phases in the study** : The phases in the study are as follows:

1. Analysis phase
2. Design phase
3. Preparatory phase
4. Implementation phase
5. Evaluation Phase.

3. **Procedure**

1. The content of Std. VII Mathematics syllabus was thoroughly analyzed.
2. The instructional objectives for each unit were defined and specified in terms of students learning behaviour.
3. The Constructivist lesson plans for all 24 units were prepared and implemented.
4. At the end of each unit a formative test of 10 marks was administered to both the groups.
5. The formative test scores were analysed objective-wise to study how well each student has performed on each learning objective.
6. Error patterns were established and students' "talk through" sessions were conducted in order to find the faulty construct leading to incorrect response.
7. At the end of entire portion, a criterion-referenced test of total 80 marks was administered to the students of two groups.

4. Statistical Techniques

The lack of equivalency between control group and experimental group was compensated by ANOCOVA. Also, the post-test scores were analysed objective-wise to study the difference between achievements of students of two groups on each objective. This was done by calculating the percentage of correctly answered questions on each objective for both the groups.

Conclusions:

1. \( F_{0.01} = 0.00026 \) is not significant at 0.01 level and at 0.05 level.

\( (F_{0.05} = 3.92 \text{ and } F_{0.01} = 6.95) \)

This shows that there is no significant difference between the post-test mean scores of control group and experimental group. The slightly high mean score of experimental group is merely by chance and it does not indicate that Constructivist teaching was really effective than the traditional teaching.

2. However, it is seen that the students of experimental group have performed better on higher-level instructional objectives such as application, process and skill in comparison with the students of control group.
3. These results cannot be taken as total failure of Constructivism as construction is a continuous process and we cannot expect positive results within the period of one year. If practised regularly, Constructivism will definitely help the teacher to eliminate the mental blocks in the students' learning of Mathematics at every level in schooling. If the basic knowledge is strengthened, the students will be able to learn higher order concepts more easily.

4. The students' opinionnaire administered to the experimental group revealed that nearly 85 per cent students had strongly favorable opinion about Constructivist approach.

Chapter 4: Pilot Study

This chapter discusses the objectives of pilot study, its procedure, statistical analysis of the post-test scores.

The main objective of pilot study was to check the feasibility of Constructivist teaching programme so that the researcher could make due modifications in the same. Pilot testing was done on a different sample in the same school. The research design was of quasi-experimental type. The paradigm for the design is as follows:

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</tr>
<tr>
<td>Control group</td>
<td>$T_1 C$</td>
<td>--</td>
<td>$T_2 C$</td>
</tr>
</tbody>
</table>
The students of experimental group were taught by Constructivist approach by the researcher and the students of control group were taught by another teacher by traditional method. At the end of each lesson a worksheet was given to the students in order to establish the error patterns of the students of experimental group. After teaching all of 24 lessons, a criterion-referenced test of 100 marks was administered to two groups. The scores were analysed by ANOCOVA.

**Item Analysis of Post-test:**

The post-test included total 55 test items comprising of a set of items designed to assess the performance on each instructional objective viz. knowledge, comprehension, application, analysis-synthesis and skill. The difficulty index (P) was calculated for each item using the formula:

\[ P = \frac{\text{No. of correct answers}}{\text{No. of subjects responding}} \]

For each set of objective-wise items, only those with somewhat similar P values were retained. Extremely easy (P = 1.0) and very difficult or ambiguous items (P < 0.05) were discarded. Thus a revised post-test of 80 marks was prepared.

**Results**

F value (F_{yx} = 0.01107) is negligible at 0.05 and 0.01 level indicating that the means of two groups do not differ significantly.
Modifications made in the constructivist Teaching Programme

1. Lesson plans were slightly updated taking in view the time required for completion and other activities scheduled by the school.

2. Instead of worksheets, formative evaluation was preferred.

3. Post-test was revised by calculating item-difficulty index for each item.

4. At the end of the Constructivist teaching programme, instead of liking scale, an opinionnaire was planned to be administered to the students of experimental group.

Chapter 5 : Statistical Analysis of Data :

This chapter discusses the objectives and procedures of ANOCOVA. ANOCOVA is employed in order to compensate the lack of equivalency between experimental group and control group as the subjects are not matched on any variable.

Also, the percentage of correctly answered questions on each objective was calculated for both the groups. It has been presented in the tabular as well as graphical form in the chapter 5.

1. Results of ANOCOVA :

a. $F_{yx} = 0.00026$ shows that mean scores of experimental group and control group do not differ significantly ($F_{0.05} = 3.92$ and $F_{0.01} = 6.95$)

b. Thus, both the methods are equivalent in terms of achievement of subjects of two groups on the post-test.
However, the percentage of correctly answered questions on each objective shows that the students of control group have done better on knowledge and comprehension objectives. Whereas, the students taught by Constructivist approach have shown higher level of proficiency on application and process objectives.

Chapter 6: Summary

This chapter gives the abstract of the research including the statement of the problem, operational definitions of key terms included in the statement, objective of the study, the hypotheses, sample details, methodology, findings of the study, scope and limitations of the study and the recommendations for the further study.

1. **The Statement of the Problem**:

   "A study to test effectiveness of Constructivist approach to teaching Mathematics at Middle School Level".

2. **Method**:

   The researcher implemented the Constructivist approach to teaching Mathematics on the students of Std. VII studying in S.P.M. English School, Pune. The researcher studied the effect of Constructivist teaching programme on the achievement of students in terms of instructional objectives viz. knowledge, comprehension, application, process and skill. Formative evaluation and criterion-referenced post-test were used as tools to test the effectiveness of Constructivist teaching programme.
3. **Findings:**

There was no significant difference between the post-test mean scores of the experimental group and control group. However, the students taught by Constructivist approach attained relatively higher level of proficiency on the application and process objectives. Also, they were benefited by interactive sessions held with them by the teacher.

The suggestions, implications of the study and more detailed observations have been given earlier, in this chapter.