SUMMARY, CONCLUSION AND SUGGESTIONS

- Study in retrospect
- Major findings of the study
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- Educational Implications
- Suggestions for Further Research
SUMMARY, CONCLUSION AND SUGGESTIONS

This chapter presents the entire study in a nutshell, highlighting the major findings emerged from the study, conclusions arrived, tenability of hypotheses, the educational implications and the suggestions for further research.

5.1 STUDY IN RETROSPECT

This section looks back at the title, variables, objectives, hypotheses, tools, and statistical techniques of the study.

5.1.1 RESTATEMENT OF THE PROBLEM.

The present study was entitled "EFFECT OF MASTERY LEARNING STRATEGY ON PROBLEM SOLVING ABILITY IN PHYSICS OF SECONDARY SCHOOL STUDENTS."

5.1.2 VARIABLES

The variables of the present study were as follows.

Dependent Variable

In the present study, Problem Solving Ability (Total Score and Component wise Score) was treated as the dependent variable.

Independent Variable

The independent variable for the present study was the Instructional Strategy (Mastery Learning Strategy/Conventional Strategy).
Controlled Variables

The controlled variables were Non-verbal intelligence, Verbal Intelligence, Socio-Economic Status, Previous Achievement and Sex

5.1.3 OBJECTIVES

The objectives of the present study are presented below as one general objective and a set of specific objectives.

General Objective

To find out the effect of Mastery Learning Strategy on the Problem Solving Ability in Physics of secondary school students.

Specific Objectives

1. To find out the effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability in Physics of students of Standard IX.

2. To find out the effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on the first component of Problem Solving Ability (Comprehending the Problem) in Physics of students of Standard IX.

3. To find out the effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on
the second component of Problem Solving Ability (Clarifying the Problem) in Physics of students of Standard IX.

4. To find out the effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on third component of Problem Solving Ability (Finding solution to the problem) in Physics of students of Standard IX.

5. To study the Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability for the total sample.

6. To study the Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability for girls of the total sample.

7. To study the Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability for boys of the total sample.

8. To study the Main effects and Interaction effect of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability for total sample.
9. To study the Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability for girls of the total sample.

10. To study the Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability for boys of the total sample.

5.1.4 HYPOTHESES

1. There will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability in Physics of students of Standard IX.

2. There will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability component 1 viz; Comprehending the Problem, in Physics of students of Standard IX.

3. There will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability component 2 viz; Clarifying the Problem, in Physics of students of Standard IX.
There will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability component viz; Finding Solution to the Problem, in Physics of students of Standard IX.

There will be significant Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence on those Components of Problem Solving Ability upon which there existed an effect of Instructional Strategy, for the total sample.

There will be significant Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence on those Components of Problem Solving Ability upon which there existed an effect of Instructional Strategy, for girls of the total sample.

There will be significant Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence on those Components of Problem Solving Ability upon which there existed an effect of Instructional Strategy, for boys of the total sample.

There will be significant Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability, for the total sample.
9. There will be significant Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability, for the girls of the total sample.

10. There will be significant Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability, for the boys of the total sample.

5.1.5 TOOLS

The data necessary for the study was collected using the following tools

(i) Raven’s Standard Progressive Matrices

(ii) Verbal Intelligence Test based on triarchic theory

(iii) Socio-Economic Status Scale

(iv) Standardised Achievement test developed by the investigator (The Pre test scores were taken as a measure of Previous Achievement. Whereas the gain scores i.e., the difference between post test scores and pre test scores, were taken as a measure of achievement of the study groups).

(v) Problem Solving Ability Test in Physics developed by the investigator
5.1.6 STATISTICAL TECHNIQUES USED

(i) One way Analysis of Covariance
(ii) Two tailed test of significance of difference between means.
(iii) Three way Analysis of Variance
(iv) Two way Analysis of Variance

5.2 MAJOR FINDINGS OF THE STUDY

The major findings of the study revealed through the various statistical analyses are the following.

1. There is no significant effect of Mastery Learning Strategy on the total score of Problem Solving Ability in Physics for the secondary school students.

2. There is no significant effect of Mastery Learning Strategy on the first component of Problem Solving Ability, viz; Comprehending the Problem in Physics for the secondary school students.

3. There is significant effect of Mastery Learning Strategy on the second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for the secondary school students.

4. There is no significant effect of Mastery Learning Strategy on the third component of Problem Solving Ability, viz; Finding Solution to the Problem in Physics for the secondary school students.

5. There is no significant effect of the factors, Nonverbal Intelligence and Verbal Intelligence on the second component of
Problem Solving Ability, viz; Clarifying the Problem in Physics for the secondary school students.

6. There is significant effect of Mastery Learning Strategy on second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for girls of the secondary school. Whereas there is no significant main or interaction effects of the factors, Nonverbal Intelligence and Verbal Intelligence on the second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for girls of the secondary school students.

7. There is no significant effect of Mastery Learning Strategy on second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for boys of the secondary school. Also there is no significant main or interaction effects of the factors, Nonverbal Intelligence and Verbal Intelligence on the second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for boys of the secondary school students.

8. There is no significant effect of Previous Achievement on the second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for the secondary school students.

9. There is no significant effect of Previous Achievement on the second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for girls of the secondary school.

10. There is no significant effect of Previous Achievement on the second component of Problem Solving Ability, viz; Clarifying the Problem in Physics for boys of the secondary school.
5.3 TENABILITY OF HYPOTHESES

5.3.1 The first hypothesis states that “there will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability in Physics of students of Standard IX.”

The ANCOVA with Instructional Strategy as the independent variable and Problem Solving Ability (Total gain score of Problem Solving Ability) as the dependent variable treating the controlled variables namely, Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates ascertained that effect of Instructional Strategy on the total score of Problem Solving Ability is not statistically significant. Therefore the first hypothesis is rejected.

5.3.2 The second hypothesis states that “there will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability component 1 viz; Comprehending the Problem, in Physics of students of Standard IX.”

The ANCOVA with Instructional Strategy as the independent variable and Problem Solving Ability component 1 viz; Comprehending the Problem as the dependent variable treating the controlled variables namely, Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates ascertained that the effect of Instructional
Strategy on Comprehending the Problem is not statistically significant. Therefore the second hypothesis is fully rejected.

5.3.3 The third hypothesis states that “there will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability component 2 viz; Clarifying the Problem, in Physics of students of Standard IX.”

The ANCOVA with Instructional Strategy as the independent variable and Problem Solving Ability component 2 viz; Clarifying the Problem as the dependent variable treating the controlled variables namely, Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates ascertained that the value is significant at 0.05 level. Hence the effect of Instructional Strategy on Clarifying the Problem is statistically significant. Therefore the third hypothesis is fully substantiated and hence retained.

5.3.4 The fourth hypothesis states that “There will be significant effect of Instructional Strategy (Mastery Learning Strategy/Conventional Strategy), with Nonverbal Intelligence, Verbal Intelligence and Previous Achievement as covariates, on Problem Solving Ability component 3 viz; Finding Solution to the Problem, in Physics of students of Standard IX.”

The ANCOVA with Instructional Strategy as the dependent variable, Problem Solving Ability component No.3 (Finding Solution to the Problem) as the independent variable treating controlled variables namely, Nonverbal Intelligence, Verbal Intelligence and Previous
Achievement as covariates ascertained that the effect of Instructional Strategy on Finding Solution to the Problem is not statistically significant. Therefore the fourth hypothesis is rejected.

5.3.5 The fifth hypothesis states that "There will be significant Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence on those Components of Problem Solving Ability upon which there existed an effect of Instructional Strategy, for the total sample."

The ANOVA performed for the total sample with factors Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence upon the Problem Solving Ability component No.2. viz; Clarifying the Problem for the total sample ascertains that none of the factors, Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence has an effect on Clarifying the Problem, when the total sample is considered. Therefore the fifth hypothesis is rejected.

5.3.6 The sixth hypothesis states that "There will be significant Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence on those Components of Problem Solving Ability upon which there existed an effect of Instructional Strategy, for girls of the total sample."

The ANOVA performed for girls with the factors Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence upon the Problem Solving Ability component No.2. ascertains that the effect of Mastery Learning Strategy on Clarifying the Problem is significant for girls. Also it is ascertained that the other factors, Nonverbal Intelligence
and Verbal Intelligence do not significantly effect the Problem Solving Ability component No.2- Clarifying the Problem for girls. Therefore the sixth hypothesis is partially substantiated.

5.3.7 The seventh hypothesis states that “There will be significant Main effects and Interaction effects of Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence on those Components of Problem Solving Ability upon which there existed an effect of Instructional Strategy, for boys of the total sample.”

The ANOVA performed for boys with the factors Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence upon the Problem Solving Ability component No.2- Clarifying the Problem ascertained that none of the factors, Instructional Strategy, Nonverbal Intelligence and Verbal Intelligence have an effect on Clarifying the Problem when boys of the total sample are considered. Therefore the seventh hypothesis is rejected.

5.3.8 The eighth hypothesis states that “There will be significant Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability, for the total sample.”

The result of ANOVA performed with factors Instructional Strategy and Previous Achievement upon Clarifying the Problem for the total sample ascertained that Previous Achievement has no significant effect on Clarifying the Problem when the total sample is considered. Therefore the eighth hypothesis is rejected.
5.3.9 The ninth hypothesis states that "there will be significant Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability, for the girls of the total sample."

The ANOVA performed with factors Instructional Strategy and Previous Achievement upon Clarifying the Problem for the girls of the total sample ascertained that Previous Achievement has no significant effect on Clarifying the Problem when the girls of the total sample are considered. Therefore the ninth hypothesis is rejected.

5.3.10 The tenth hypothesis states that "there will be significant Main effects and Interaction effects of Instructional Strategy and Previous Achievement, if there existed any effect of Instructional Strategy, on the Components of Problem Solving Ability, for the boys of the total sample."

The ANOVA performed with factors Instructional Strategy and Previous Achievement upon Clarifying the Problem for the boys of the total sample ascertained that Previous Achievement has no significant effect on Clarifying the Problem when the boys of the total sample are considered. Therefore the tenth hypothesis is rejected.

5.4 CONCLUSION

Apart from the effect of Mastery Learning Strategy on Clarifying the Problem, it was ascertained that Mastery Learning Strategy does not significantly foster the mental processes and skills associated with Problem Solving of students better than the Conventional Strategy.
This result contradicts the research studies (Arredondo and Block 1990, Mevarech 1985, Soled 1987) which show that Mastery Learning is highly effective when instruction focuses on high-level outcomes such as problem solving, drawing inferences, deductive reasoning and creative expression.

The present study was undertaken in the changed context of the new curriculum of the state of Kerala, which emphasizes Problem Solving approach in the mode of transaction of the curriculum as well as in the presentation of content in the textbook. Thus Mastery Learning Strategy was compared against the Conventional Strategy based on collaborative learning and problem solving approach. The result of this investigation thus, could either mean that Mastery Learning Strategy is not exceedingly good when compared to the Conventional Strategy presently practised in schools or the Conventional Strategy presently practised in schools is as good as the Mastery Learning Strategy in fostering Problem Solving Ability.

Mastery Learning Strategy however, enhances the thought processes and mental skills associated with Clarifying the Problem especially in girls.

Taking a closer look at the subcomponents of Clarifying the Problem, it can be seen that they consist of usual thought processes usually employed in the classroom situation and much necessary for academic exercises as compared to the subcomponents which come under the other two components of Problem Solving Ability. The subcomponents of Clarifying the Problem are Ability to discriminate between the most relevant and closely related concepts, Using analogies
for reasoning, Using Inductive/deductive reasoning, Hypothesizing, Checking the testability of hypotheses. The enhancement of such abilities is due to the fact that in repeated sessions of corrective measures / remedial measures of the Mastery Learning Strategy Cycle, the students were made to think and master the content repeatedly, during which such mental processes were indispensable. Thus the gender difference in acquiring Problem Solving Ability through Mastery Learning Strategy could be accounted considering the fact that girls take up more sincerely the corrective and remedial measures in a disciplined manner whereas boys rather went through the procedures casually without much mental deliberation. And thus girls got themselves rewarded.

It follows that the abilities indicated by the components Comprehending the Problem and Finding solution to the Problem need to be included in the routine academic exercises practised in the classroom situation. This could be made possible by giving opportunities for the students to deal with a variety of life related curricular problems after attaining mastery of the concept and content.

Even though the effect of Nonverbal Intelligence, Verbal Intelligence and Previous Achievement is negative upon the increased Problem solving ability, its implication happens to be positive. To put it clearly, the above-mentioned factors, which are to some extent predetermined, do not influence the enhancement of Problem Solving Ability. Thus a teacher with a new strategy, which would increase Problem Solving Ability, can hope to make the effect in almost all
students irrespective of their Intelligence level and Previous Achievement level.

5.5 EDUCATIONAL IMPLICATIONS

In the present study the investigator attempted to find out the effect of Mastery Learning Strategy on the Problem Solving Ability in Physics of secondary school students.

It was found that Mastery Learning Strategy does not significantly foster the mental processes and skills associated with Problem Solving of students better than the Conventional Strategy. Mastery Learning Strategy however, enhances the thought processes and mental skills associated with Clarifying the Problem especially in girls.

The present study was undertaken in the changed context of the new curriculum of the state of Kerala, which emphasizes Problem Solving approach in the mode of transaction of the curriculum as well as in the presentation of content in the textbook. Thus Mastery Learning Strategy was compared against the Conventional Strategy based on collaborative learning and problem solving approach. The result of this investigation thus, could either mean that Mastery Learning Strategy is not exceedingly good when compared to the Conventional Strategy presently practised in schools or the Conventional Strategy presently practised in schools are as good as the Mastery Learning Strategy in fostering Problem Solving Ability.

Anyhow, in the light of the present investigation, it is obvious that repeated learning, even though with alternate learning experiences, limited by the curriculum in the school context do not significantly
contribute to the enhancement of Problem Solving Ability. More time spent with enrichment and remedial measures can definitely improve Achievement and Problem Solving Ability associated with Clarifying the Problem but the original ability to interiorise a problem and the crucial ability to solve the problem cannot be significantly trained for improvement.

The researcher feels that even deeper exposures made to the once-familiar situations do not increase Problem Solving Ability in its real sense. To develop the original abilities of Problem Solving, students should be made to realize that there is more than one way of solving a single problem. The transfer of training helps the student to solve stereotyped problems by training and practice. But the original ability to solve problems develops only by handling diverse problems. Students should work out different problems on the same concept using different intellectual ways.

It also follows that the abilities indicated by the components Comprehending the Problem and Finding solution to the Problem need to be explicitly included in the routine academic exercises practised in the classroom situation. Diverse problems require different patterns of thinking, different styles of solving and different abilities that constitute for Problem Solving from the part of the problem solver. Thus it is imperative that the textbook and the process of curriculum transaction employ diverse problematic situations associated with a single topic so as to foster the ability to solve problems in Physics as well as in life.

5.6 SUGGESTIONS FOR FURTHER RESEARCH

Keeping in view the limitations of the present study, and the constraints under which it was conducted, the findings do not warrant
wide generalization. It is therefore, felt that replication of this study on a larger sample is requisite to arrive at still reliable and precise results to test the effect of Mastery Learning Strategy on Problem Solving Ability. Also the researcher feels that other studies related to Problem Solving Ability should be conducted on the following themes.

1. Effect of different Problem Solving Approaches on increasing Problem solving Ability could be studied.

2. The relation between life related problem solving abilities and curriculum related problem solving abilities could be explored.

3. The relation between problem solving ability and other aspects of thinking like, divergent thinking and convergent thinking could be analysed.

4. Effect of Mastery Learning Strategy on Problem Solving Ability could be studied using a larger sample and ensuring both boys and girls are equally serious in going through the Corrective Measures/ Enrichment Activities, which form part of the Mastery Learning Strategy.

5. Effect of Mastery Learning Strategy on Problem Solving Ability could be studied using a larger sample concentrating on each subcomponent of Problem Solving Ability and monitor the effect at a micro level.