CHAPTER V
THE SUMMARY OF FINDINGS AND RECOMMENDATIONS

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CHAPTER V

THE SUMMARY OF FINDINGS AND RECOMMENDATIONS

Introduction

This chapter presents a summary of findings of the study. The present investigation is an attempt to study the effectiveness of various instructional strategies on achievement in science and interaction of high school students in Coimbatore.

The salient findings of this study are brought together in this chapter. On the basis of the findings emerging from the study and discussion, the investigator also suggests some areas for further research. The educational implications of the findings of the study in the light of the present research are also presented in this chapter.

The salient findings of both quantitative as well as qualitative analyses of the study are presented as follows:

Inference through Students Achievement

1. In general, the achievement of the students differs to a great extent on the basis of the nature of instructional strategies. The 'F' value 11.097 was found to be significant at 0.01 level. Comparison of the means of different instructional strategies reveals that multimedia strategy results in higher achievement than other strategies.
2. No significant difference could be noticed between the achievement pattern of students (in the light of instructional strategies) on the basis of standards. ANOVA source table reveals that the F-value (1.482) is not statistically significant at 0.05 level. Hence it can be inferred that the standard of students is not contributing to the preference of any particular instructional strategy. Irrespective of the standards, students perform well in multimedia strategy.

3. The achievement scores indicate that there is no significant interaction between the instructional strategies and standard. The F-value obtained for the interaction between the variables is 1.998 which is lower than the table value. Since the interaction in this case is not significant, it can be generalised that the nature of instructional strategy alone has an impact on the achievement of the students.

4. In the case of post-test scores of students of standard VIII, the differences do exist among the groups which were taught through a particular instructional strategy. The F-ratio (2.671) is significant at 0.05 level.

5. While comparing the post-test scores on the basis of gender of students of standard VIII, the t-values between the boys and girls in all the four strategies namely, conventional learning, programmed learning, cooperative learning and multimedia approach are statistically significant at 0.05 level. Hence it can be inferred that girls show better achievement than boys irrespective of the instructional strategy adopted by the teacher.
6. A significant difference could be noticed between the post-test achievement scores of boys and girls of standard VIII in all the three innovative instructional strategies except in the conventional learning. The t-value obtained in the case of programmed learning is 2.11, which is significant at 0.05 level. In the programmed learning strategy, the rural students' achievement is higher than that of the urban students. In the case of cooperative learning and multimedia, the t-values obtained are 2.38 and 2.35 which are significant at 0.05 level. Hence it is inferred that these two strategies are more effective in the case of urban students than that of the rural students.

7. While comparing the achievement of students of IX standard, based upon the instructional strategies, a significant difference at 0.05 level could be noticed (F = 3.039) Therefore, it is inferred that the main effect instructional strategy has a significant impact on the achievement of students of IX standard. The mean values reveal that cooperative learning and multimedia have contributed towards the achievement of students at standard IX than other strategies.

8. While comparing the achievement of girls with that of boys of standard IX, a statistically significant difference could be noticed in all the four strategies. The t-values obtained for conventional learning, programmed learning, cooperative learning and multimedia are 2.33, 2.43 2.61 and 2.54 respectively. As these t-values are significant, it is inferred that the girls show better achievement than that of boys irrespective of the teaching strategies.
9. While comparing the achievement of students of standard IX on the basis of locality, a significant difference is noted in the case of the innovative strategies, whereas the conventional learning did not show any difference \((t = 0.63)\). The \(t\)-value in the case of programmed learning is 2.07. For cooperative learning it is 2.01 whereas in multimedia, the \(t\)-value is 2.21 which are significant at 0.05 level. Hence it is inferred that those schools located in urban areas make use of the innovative methods than that of the schools located in rural area.

**Inference through Attitude scores of students.**

10. A significant difference at 0.05 level \((F=3.484)\) could be noticed between the attitude changes of the students on the basis of instructional strategies. Hence it is inferred that the main effect instructional strategy has a significant impact in the case of attitude also. However, the attitude change noticed in the case of cooperative learning strategy \((t = 6.55)\) is far superior than the other instructional strategies. Another important finding is that the multimedia strategy which contributed for the better achievement has less impact on attitude \((t = 4.80)\).

11. A significant difference was found between the attitudes of students of standard VIII on the basis of gender. The \(t\)-values obtained were: conventional learning - 2.28, programmed learning - 3.10, cooperative learning - 1.98, and multimedia - 2.45, all significant at 0.05 level. The results reveal that the girls showed a better attitude about the teaching learning process than that of boys.
12. A significant difference between the attitudes of students of standard VIII on the basis of locality is noted in the case of cooperative learning \((t = 2.01)\) and multimedia \((t = 2.30)\). The obtained \(t\)-ratio for conventional approach \((1.18)\) and programmed learning \((0.86)\) are not significant. These values indicate that the urban students make better use of innovative instructional strategies than that of rural students.

13. It has been found that the attitude changes of students of standard IX on the basis of instructional strategies was significant \((F = 2.725)\) at 0.05 level. The \(t\)-ratios obtained for the strategies, namely, programmed learning \((2.30)\), cooperative learning \((6.59)\) and multimedia \((4.19)\) also support this finding. Hence it is inferred that the innovative instructional strategies in teaching influence positive attitude of students towards teaching-learning process.

14. While comparing the post test attitude scores of boys and girls, it is found that gender has an impact on the attitudes of students of standard IX. The \(t\)-ratios obtained are: conventional learning \((1.99)\), programmed learning \((2.00)\), cooperative learning \((2.72)\) and multimedia \((2.51)\) which are significant at 0.05 level. So it is deduced that the positive attitude of girls is better than that of the boys.

15. The comparison of attitude scores on the basis of locality reveals that there is no impact of the conventional and programmed learning strategies in enhancing the attitude of either rural or urban students of standard IX, whereas the impact is noticed in cooperative learning and multimedia strategies.
Inference through Attitude Scores of the Teachers

16. A significant ($t = 4.91$) difference at 0.01 level could be noticed between the attitude of the teachers as a result of the application of a new instructional strategy in the classroom. It is inferred from the analysis that teachers attitude towards teaching-learning process improves as a result of the various innovative instructional strategies.

17. While comparing the attitude scores of male and female teachers, a significant difference ($t = 4.12$) at 0.01 level could be noticed. Female teachers show better attitude than male teachers towards teaching-learning process.

18. The main effect 'location of the schools' did not make an impact on the attitude of the teachers. The calculated $t$-value (0.77) is lower than the table value. Hence it is inferred that the attitude of the rural teachers is not too different from that of urban teachers in terms of instructional strategies.

19. A significant difference was found in the attitude of teachers on the basis of their experience ($t = 3.96$). The teachers with more than 5 years of experience have better attitude towards teaching and learning than those who have less than 5 years of teaching experience.

Inference through Students Interaction Inventory

20. The componentwise analysis of the Student Interaction Inventory indicates that all the five thematic scores obtained by the students classified under different instructional strategies are showing considerable differences.
With regard to the component 'Peer Group Interaction', the highest percentage (89.2) is found in the case of cooperative learning, followed by multimedia (80.9%), conventional learning (57.4%) and programmed learning (46.5%). Hence it is inferred that in cooperative learning strategy, the peer group interaction is more effective than the other three strategies.

21. While analysing the Adjustability aspects, the same trend noticed in 'Peer Group Interaction' is found. The minimum percentage (41.2%) noticed is in the case of programmed learning and the maximum percentage (82%) is in the cooperative learning strategy. So, it is inferred that the 'Adjustability' dimensions are found high in the case of cooperative learning group and the minimum impact is on the programmed learning students.

22. In the case of 'Initiative Behaviour' the percentages obtained are almost equal in cooperative learning strategy (81.2%) and multimedia approach (80.7%). The percentage obtained in conventional learning (76.2%) is higher than that of the programmed learning (62.1%) strategy. Therefore it can be inferred that the initiative behaviour of students learnt through programmed learning is not so effective when compared to the other types of instructional strategies, viz., conventional, cooperative learning, and multimedia.

23. The analysis with respect to 'Information Dissemination' gives an indication that it is a significant impact in the case of multimedia approach (88.4%). It is followed by programmed learning (81.63%), cooperative learning (71.9%) and conventional learning (69.8%). Hence it is inferred that multimedia strategy facilitates better information dissemination among students.
24. Participation in 'Social Activities' is the fifth theme included in the Social Interaction Inventory. The percentage obtained for cooperative learning (79.3%) is very high compared to that of the other strategies. The lowest percentage is obtained in the case of programmed learning (57.4%). The percentages for multimedia (71.7%) and conventional learning (68.0%) fall in between cooperative learning and programmed learning. Hence it is inferred that the students who learnt under cooperative learning have high inclination towards participation in social activities.

25. As found in the investigation, multimedia approach mostly contributes for cognitive development whereas the peer group interaction and development of positive attitudes among students are influenced by cooperative learning.

Discussion

The goals of the study were to examine the effectiveness of various instructional strategies on the achievement and attitudes of the students of eighth and ninth standard in learning science. It was also aimed at studying the effect of various instructional strategies, viz., conventional learning, programmed learning, cooperative learning and multimedia on the attitude of the teachers of science of the above standards. The following discussion deals with the various outcomes of the study in comparison with previous investigations.

The investigator in this study found a significant improvement in the achievement of students after they were exposed to various innovative instructional strategies except in the case of the conventional learning. In a study conducted by Kumar (1981), it is reported that the multimedia was more effective than other conventional methods. Fan (1990) felt that cooperative learning and
teaching had a strong positive effect upon academic achievement. In supporting the finding of Fan, Needham (1990) revealed that cooperative learning in general had a positive impact on achievement when compared with traditional classroom practices.

Mavateel (1991) also found that students exposed to cooperative learning could perform better than those given more traditional instruction. As was found in this investigation, programmed learning strategy is better than conventional learning. This finding is supported by Sharma (1966) and Kulkarni (1969) who also proved that the programmed learning approach is effective.

When the achievement scores of students were analysed in terms of gender, the investigator found that the girls in general performed better than that of boys. In contrast, a study conducted by Bhatt (1922) reveals that there was no clear cut evidence of difference in performance on the basis of gender in the area of teaching of science.

The investigator also made an attempt to study the effectiveness of various instructional strategies on the students studying in different standards. Though this study was confined only with the students of VIII and IX standards, it gave a strong evidence that the innovative instructional strategies like programmed learning, cooperative learning and multimedia are more effective than the conventional method irrespective of the standards.

Majority of the results of the present study, in terms of achievement, are conforming with that of studies conducted in the past. Since no study included both achievement and attitude with reference to four instructional strategies, discussion on the combined effects of these variables could not be made.
Recommendations

The following recommendations emerge as a result of this study:

Inservice to teachers on Innovative Instructional Strategies and Students Development

Science plays a vital role in the development of many qualities of head and heart in the individual thereby helping him to be a good citizen in the society which in fact, in the crucial need of the hour. It helps him to be a useful, productive and progressive member of the society. It makes him intellectually enlightened, vocationally fit and morally sound.

Science develops in students the qualities like truthfulness, honesty, open mindedness, adjustability, initiative behaviour, and goodness. It makes him free from false-beliefs and superstitions. Because of the above-mentioned values of science, it finds a very important place in today's high school curriculum. Everybody is expected to study science up to high school level.

The development of these qualities of head and heart depend not only on the study of the sciences by the students but also by the way of teaching of the science subjects.

The approach and style of presenting the science instructions to the students is very important for the development of these qualities. The study reveals that the students who are exposed to innovative instructional strategies perform better. Therefore, it is recommended that the school teachers update themselves with the latest methods of teaching to facilitate the overall
development of students. Organising inservice courses in this area becomes the need of the hour. The Extension Services Departments attached to the Colleges of Education, Universities and Academic Staff Colleges need to give priority to innovative strategies and organise inservice programmes for teachers.

The need for revamping teacher preparation curriculum in the light of innovative instructional strategies

The Teacher preparation is a crucial area for educational change and development. The teacher education curriculum includes training techniques such as micro teaching, models of teaching and macro teaching, etc. Programmed Learning, Cooperative learning and Multimedia should be made compulsory in practical aspects so that the students and teachers develop the right attitude towards teaching-learning process before they join as regular teachers in schools.

Experiences of voluntary organisations like All India Association for Educational Technology (AIAET) New Delhi, and Media Centres should be included in introducing and implementing the innovative instructional strategies.

The administrative head of the institutions, particularly at the school level, must be motivated for implementing these strategies. The State Education Departments through the State Councils of Educational Research and Training may organise orientation courses to the headmasters and principals of the schools to familiarise them with the innovative instructional strategies. The results of the study need to be discussed with student teachers, teacher educators and experts so that the appropriate changes can be made in the curriculum in order to prepare skilled teachers.
Need for Instructional Strategies towards the Wholistic Development of the Student

The question of survival is linked with the new social order. Today, we have to think of an education for survival, survival not through the path of exploitation but through the path of love and affection. So these instructional strategies like cooperative learning which provide ample chances for peer group interaction will pave way for better social interaction.

The present educational world talks of the 'information age' but more important than that is the need for human ethics and human values, and not only of information but of 'information and reformation' of the whole man. Cooperative learning seems to assist the wholistic development of the individual, and therefore, its impact must be made known to students through curriculum as well as co-curricular activities.

Curricular changes to be effected by the Government Agencies

An educational reconstruction in the line of curriculum and innovative instructional strategies is a vital need in accordance with the changing trends in the field of education. For this, the education department and Government in general could conduct a periodical diagnosis of the educational problems, particularly that of the methods of teaching. Keeping in view the present educational scenario as emerged from the study, the following measures are suggested.

i. Facilities given to city schools may be provided to rural schools also so that the methods of instruction are compatible with that of the needs of students and the skills of teachers as well.
ii. Incentives can be provided to those teachers who attempt for 'innovation' in teaching. The existing scheme of NCERT in identifying talents in teachers, particularly in the area of innovation, needs to be popularized among teachers. From informal discussions with the teachers, it is evident that such schemes are not fully known to majority of them.

The present evaluation system is based mainly on the 'achievement' aspects. This study revealed that the achievement of students improved significantly after taught through these strategies. These findings must be made known to all teachers so that they evince interest in following these instructional strategies.

As envisaged in the National Policy on Education, innovative instructional strategies can be used effectively for various programmes of formal and non-formal education, if perfect management in the education sector is achieved right from institutional level to the national level. For all these to happen, the Government should conform to the same forms of physical possibility, educational feasibility, financial viability and social acceptability. The present study which was conducted at the micro level of the innovation in education confirms with that of the policy perspectives of the NPE, especially in the area of instructional strategies. Therefore, the government agencies have a role to play in popularising a variety of instructional strategies that optimise the learning experience of the students.

Need for Textual changes as related to Innovative Instructional Strategies

Traditionally, a text-book has been an unavoidable instrument in any teaching-learning process. Next to the teachers' oral presentation, the text-book is
the most widely used teaching instrument. Over-dependence on the text-books limits the advantages of its use. The text-book should never be allowed to dominate the teaching programme in Science. The text book is a means to an end and not an end by itself. A good book stimulates thinking in the minds of the learners besides supplying necessary information of science. Since a good text book provides not only the contents of science but also determines the method of teaching, a textbook therefore, occupies an important place in the classroom situation. So the textbooks in the future must be able to acknowledge the curiosity of the learner. In general, the book should be in such a way that the lessons create an interest in science, develop the sense of appreciation and power of thinking, reasoning, observation and judgement. Besides giving the learners factual knowledge, it should help them to develop technical skills, scientific attitude and train them in the scientific method.

As revealed in the study, the nature of achievement has a direct correlation with the type of instruction also. Instruction is the generic term and it is not just the information given by the teacher, but also the indirect information provided through the text material. Materials geared towards programmed learning indeed develop the intellectual ability of the students but they have less impact on the attitude formation. On the other hand, instructional strategy such as the cooperative learning has more effect on the affective domain of the students, in which the type of text becomes secondary. The presence of these extremes is not conducive keeping in view the general educational scenario which is dominated by textbooks. Therefore, the instructional changes should start from the changes in the presentation of the textbook itself. It should not provide dry information in pages put together but it should include illustrations, self evaluation sheets, activity charts, etc. which are advocated in innovative instructional strategies.
Presentation of such text books will really bring out the creativity of the learner. The overall student achievement and positive attitude development can be made possible through properly designed textbooks. Therefore, the textbook writers must be oriented about the results of the study so that necessary incorporation of content can be made at all levels in the future.

**Parental Awareness about Instructional Strategies and Student Development**

The greatest satisfaction from a well educated child is felt by the parents but for making this happen, parental sacrifice is necessary. But the question is how many of them plan the education of their children? Children learn by their parents’ example - they tend to emulate them. So the role of parents in the learning process is very important - as important as that of teachers. Though textbooks in education highlight optimistic statements that education starts at home, the modern day social system indicates that there are scores of ineffective parent teachers for various reasons. The parents are confused about the methods of teaching adopted by the teachers in schools and their perception of child’s learning. Most of the parents are result oriented due to the competitive approach in schools, whereas they very much realise that the child can be taught through unstructured methods. As Piaget points out, the child should not be taught but a proper environment must be created for the child to learn. Awareness about the different types of instructional strategies to the parents will help them to guide the child properly. This will also help them to interact with the teachers in a purposeful manner keeping in view the overall personality development of the child. Therefore, organisations such as teacher preparation centres may organise oriented programmes not only for teachers but also for the parent representative groups. In this context, the Parent Teacher Association (PTA) can
play a vital role in making this happen. Therefore, there is a need to share the results of the study in parent teacher association meets at the district level.

Suggestions for further Research

The purpose of any investigation in education is to find solutions for problems in methods of teaching, learning, classroom management, interaction, etc., but investigation on a single problem is not the terminal point of the research. It leaves many related research questions that can be investigated by other researchers. The following suggestions are made for further research in this area:

1. This study was conducted in Coimbatore district only. This may be extended to other districts in the State and other States in the country.

2. The research done by the investigator can be replicated with students of Standard I to XII. This will indicate the type of innovative strategies useful for different standards.

3. The study could be extended and tried at Collegiate level also.

4. The present research was confined to Science only, but the innovative strategies should work with all subjects too. Investigation in the future may include areas such as language, arts, maths, history, etc.

5. The influence of innovative instructional strategies on the problem solving of skills of the students is also a potential area for research.

6. A comparative study may be conducted to find out the effectiveness of various instructional strategies at different levels namely, primary, secondary and higher secondary level.

7. A study may be conducted to find out the effectiveness of innovative instructional strategies in teacher preparation.
Conclusion

The modern world is a scientific world and today it is everybody's concern. In view of the dominating role of science in the modern world, it has been considered imperative for any nation of the world to promote science education in their country. We cannot expect improved science education in the higher education stage unless we succeed in providing a sound science education in schools.

Improved science education in schools depends upon teachers properly trained in the instructional strategies of science. In this way, the research study of the investigator can be considered as a small but a significant contribution to education especially at a time when the educationists are exploring innovative methods to improve the teaching-learning process in the classroom. Innovative instructional strategies can really make a difference in the attitude and achievement and also on the personality development of the students. So there is a need to employ a combination of all these strategies to make the teaching-learning process more interesting, effective and purposeful. This study is just an attempt in this line of thinking and there is a tremendous need and scope for further research in this area. Hence, this research is not the end of an important problem, but just a beginning of the search for innovations and innovative instructional strategies....