SUMMARY OF PROCEDURE AND CONCLUSIONS

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SUMMARY OF PROCEDURE AND CONCLUSIONS

This chapter of the research report provides an overview of the significant aspects of the different stages of the study.

6.1 The study in Retrospect

6.1.1 Restatement of the Problem.

The present study is entitled APPLICATION OF INFORMATION PROCESSING MODELS IN TEACHING MATHEMATICS AT SECONDARY LEVEL.

6.1.2 Objectives of the Study

1. To compare the effectiveness of Information Processing Models with the Activity Oriented Method on the Total Achievement in Mathematics of the secondary school students.

2. To compare the effectiveness of Information Processing Models with the Activity Oriented Method on the achievement in Mathematics of the secondary school students with respect to categories of objectives such as Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation.

3. To compare the effectiveness of Information Processing Models with the Activity Oriented Method on the Problem Solving Ability of the secondary school students.
4. To compare the effectiveness of Information Processing Models with the Activity Oriented Method on the Mathematical Interest of secondary school students.

5. To compare the effectiveness of Information Processing Models with the Activity Oriented Method on the Mathematical Attitude of secondary school students.

6.1.3 Hypotheses

Keeping in view the objectives of the study, following hypotheses were formulated.

1. The Total Achievement in Mathematics of secondary school students taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

2. The Objective-wise Achievement of secondary school students in Mathematics taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

3. The Problem Solving Ability of secondary school students taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

4. The Mathematical Interest of secondary school students taught using Information Processing Models is significantly
higher than that of students taught using the Activity Oriented Method.

5. The Mathematical Attitude of secondary school students taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

6.1.4 A Brief Description of the Study Conducted

The study was conducted on a sample of 310 students. Two divisions each of standard IX were selected from four schools from Kottayam and Pathanamthitta districts. Government Higher Secondary School, Kudamaloor and Girideepam Bethany English Higher Secondary School, Vadavathoor were selected from Kottayam district. M.G.M Higher Secondary School Tiruvalla and Balikamadam High School, Tholassery were selected from Pathanamthitta district. From the two divisions of each school, one was considered as the experimental group and the other one was treated as the controlled group.

Two major units Mensuration of circles and Prisms from the mathematics text book of standard IX following the state syllabus has been chosen. Lesson transcripts based on Information Processing Models [IPM] and Activity Oriented Method [AOM] were prepared. Learning materials and instructional aids were also prepared.

As it was intended to find the effectiveness of IPM and AOM in teaching mathematics, the investigator prepared and standardized an
achievement test in mathematics. Adequate weightage was given to each category of objective like knowledge, comprehension, application, analysis, synthesis and evaluation.

When the students experience the environment created by the IPM, they acquire certain nurturant effects like precise thinking, logical reasoning, inductive reasoning, sensitivity to language, interest in inquiry etc which could be reflected through their ability in problem solving. So the investigator prepared and standardized a test of problem solving ability which demanded logical thinking and reasoning from the part of the students. A mathematics interest inventory prepared by Prasannakumar and mathematical attitude scale prepared by Desai were also used in the study.

Before starting the classes, all the four tests mentioned above were administered to the experimental and to the control group as pre tests. The tests were given in identical conditions. Then the investigator herself conducted classes to both the groups. The experimental group was taught through IPM and the control group through AOM. When the classes were over, post tests were administered to both the groups using the same tools.

The scores obtained by the students in the pre test and post test were classified and subjected to statistical treatment. This included comparison of mean scores and standard deviation with a view to arrive at a rough estimate of the comparative effectiveness
followed by more precise comparison using the technique of analysis of covariance.

6.2 Findings of the Study

The findings that emerged from the study are noted below.

6.2.1 The comparison of pretest total achievement scores in mathematics of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level (critical ratio = 0.702, P > 0.05). [Vide table 5.1].

The post test total achievement scores in mathematics of pupils in the IPM and AOM group were found to be significantly different (critical ratio = 7.5, P < 0.01). The performance of the IPM group in the post test (mean = 17.03) was better than that of the AOM group (mean = 13.68). [Vide table 5.2].

The gain scores in mathematics achievement of the experimental and control groups when subjected to analysis using critical ratio (critical ratio = 26.8) showed significant difference between their mean gain scores ($M_1$ = 22.37, $M_2$ = 8.71). This data thus emphasizes the superiority of IPM group over AOM group. [Vide table 5.3].

The analysis of covariance of the pre test and post test total achievement scores of pupils in the IPM and AOM groups showed significant difference between the two groups ($F_{y.x} = 728.94$, P < 0.01). [Vide table 5.5].
The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant \( t = 27.02, \ P<0.01 \). [Vide table 5.6]. It confirms that the IPM group is superior to the AOM group in mathematics achievement.

6.2.2 The comparison of pretest achievement scores with respect to knowledge level of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level (critical ratio= 1.156, \( P>0.05 \)). [Vide table 5.7]. The post test achievement scores with respect to knowledge level of pupils in the IPM and AOM group were found to be significantly different (critical ratio = 4.876, \( P<0.01 \)). The performance of the IPM group in the post test (mean = 3.85) was better than that of the AOM group (mean = 3.34). [Vide table 5.8].

The analysis of covariance of the pre test and post test achievement scores with respect to knowledge level of pupils in the IPM and AOM groups showed significant difference between the two groups \( F_{y.x} = 23.41, \ P<0.01 \). [Vide table 5.10].

The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant \( t = 4.85, \ P<0.01 \). [Vide table 5.11]. It confirms that the IPM group is superior to the AOM group in mathematics achievement with respect to knowledge level.
6.2.3 The comparison of pretest achievement scores with respect to comprehension level of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level (critical ratio= 0.14, P>0.05). [Vide table 5.12].

The post test achievement scores with respect to comprehension level of pupils in the IPM and AOM group were found to be significantly different (critical ratio = 3.885, P<0.01). The performance of the IPM group in the post test (mean = 3.39) was better than that of the AOM group (mean = 2.95). [Vide table 5.13].

The analysis of covariance of the pre test and post test achievement scores with respect to comprehension level of pupils in the IPM and AOM groups showed significant difference between the two groups( Fy.x = 15.03, P<0.01). [Vide table 5.15].

The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant (t = 3.88, P<0.01). [Vide table 5.16]. It confirms that the IPM group is superior to the AOM group in mathematics achievement with respect to comprehension level.

6.2.4 The comparison of pretest achievement scores with respect to application level of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level (critical ratio= 0.218, P>0.05). [Vide table 5.17].

The post test achievement scores with respect to application level of pupils in the IPM and AOM group were found to be
significantly different (critical ratio = 4.71, P<0.01). The performance of the IPM group in the post test (mean = 3.0) was better than that of the AOM group (mean = 2.5). [Vide table 5.18].

The analysis of covariance of the pre test and post test achievement scores with respect to application level of pupils in the IPM and AOM groups showed significant difference between the two groups( Fy.x = 22.06, P<0.01). [Vide table 5. 20].

The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant (t = 4.70, P<0.01). [Vide table 5.21]. It confirms that the IPM group is superior to the AOM group in mathematics achievement with respect to application level.

6.2.5 The comparison of pretest achievement scores with respect to analysis level of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level(critical ratio= 0.142, P>0.05). [Vide table 5.22].

The post test achievement scores with respect to analysis level of pupils in the IPM and AOM group were found to be significantly different (critical ratio = 5.002, P<0.01). The performance of the IPM group in the post test (mean = 2.8) was better than that of the AOM group (mean = 2.1). [Vide table 5.23].

The analysis of covariance of the pre test and post test achievement scores with respect to analysis level of pupils in the
IPM and AOM groups showed significant difference between the two groups ($F_{y.x} = 25.33, P<0.01$). [Vide table 5. 25].

The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant ($t = 5.03, P<0.01$). [Vide table 5.26]. It confirms that the IPM group is superior to the AOM group in mathematics achievement with respect to analysis level.

6.2.6 The comparison of pretest achievement scores with respect to synthesis level of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level (critical ratio = 0.719, $P>0.05$). [Vide table 5. 27].

The post test achievement scores with respect to synthesis level of pupils in the IPM and AOM group were found to be significantly different (critical ratio = 6.477, $P<0.01$). The performance of the IPM group in the post test (mean = 1.65) was better than that of the AOM group (mean = 1.18). [Vide table 5.28].

The analysis of covariance of the pre test and post test achievement scores with respect to synthesis level of pupils in the IPM and AOM groups showed significant difference between the two groups ($F_{y.x} = 41.24, P<0.01$). [Vide table 5. 30].

The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant ($t = 6.43, P<0.01$). [Vide table 5. 31]. It confirms that the
IPM group is superior to the AOM group in mathematics achievement with respect to synthesis level.

**6.2.7** The comparison of pretest achievement scores with respect to evaluation level of pupils in the IPM and AOM groups showed that there was no significant difference between their pre test scores even at 0.05 level (critical ratio = 0.365, P>0.05). [Vide table 5.32].

The post test achievement scores with respect to evaluation level of pupils in the IPM and AOM group were found to be significantly different (critical ratio = 5.192, P<0.01). The performance of the IPM group in the post test (mean = 2.35) was better than that of the AOM group (mean = 1.59). [Vide table 5.33].

The analysis of covariance of the pre test and post test achievement scores with respect to evaluation level of pupils in the IPM and AOM groups showed significant difference between the two groups (Fy.x = 26.78, P<0.01). [Vide table 5.35].

The difference between adjusted means of the two groups showed that the difference between the two groups is statistically significant (t = 5.18, P<0.01). [Vide table 5.36]. It confirms that the IPM group is superior to the AOM group in mathematics achievement with respect to evaluation level.

**6.2.8** The comparison of pretest problem solving ability scores of pupils in the IPM and AOM groups showed no significant difference between the two groups (critical ratio = 0.643, P>0.05). [Vide table 5.40].
Significant difference has been found between the two groups when the post test problem solving ability scores were compared. (critical ratio = 6.245, P< 0.01). The IPM group showed better problem solving ability (mean = 13.08) than the AOM group (mean = 10.2). [Vide table 5.41].

The gain scores in problem solving ability of the experimental and control groups when subjected to analysis using critical ratio (critical ratio = 16.813) showed significant difference between their mean gain scores (M₁ = 5.94, M₂ = 2.79). This data thus emphasizes the superiority of IPM group over AOM group. [Vide table 5.42].

The analysis of covariance of the pre test and post test problem solving ability scores of pupils in the IPM and AOM groups showed significant difference between the two groups (Fₓ₁ = 281.47, P<0.01). [Vide table 5.44].

The difference between the adjusted means of the two groups showed the IPM group performed significantly higher than the control group (t = 16.79, P<0.01). [Vide table 5.45].

6.2.9 The comparison of pretest mathematical interest scores of pupils in the IPM and AOM groups showed no significant difference between the two groups (critical ratio = 0.106, P>0.05). [Vide table 5.46].

Significant difference has been found between the two groups when the post test mathematical interest scores has been compared (critical ratio = 2.446). The IPM group showed better
interest towards mathematics (mean = 25.78) than that of the AOM group (mean= 23.516). [Vide table 5.47].

The gain scores in mathematics interest of the experimental and control groups when subjected to analysis using critical ratio (critical ratio = 8.419) showed significant difference between their mean gain scores (M₁ = 6.06, M₂ = 3.69). This data thus emphasizes the superiority of IPM group over AOM group. [Vide table 5.48].

The analysis of covariance of the pre test and post test mathematics interest scores of pupils in the IPM and AOM groups showed significant difference between the two groups (F₀.₀₁ = 76.96, P<0.01). [Vide table 5.50].

The difference between the adjusted means of the two groups showed that the difference between the two groups is statistically significant (t = 8.77, P<0.01). [Vide table 5.51]. It confirms that the IPM group is superior to the AOM group in mathematics interest.

6.2.10 The comparison of pretest mathematics attitude scores of pupils in the IPM and AOM groups showed no significant difference between the two groups (critical ratio = 0.049, P>0.05). [Vide table 5.52].

Significant difference has been found between the two groups when the post test mathematics attitude scores were compared. (critical ratio = 6.245, P< 0.01) The IPM group showed better problem solving ability (mean = 13.08) than the AOM group (mean= 10.2). [Vide table 5.53].
The gain scores in mathematics attitude of the experimental and control groups when subjected to analysis using critical ratio (critical ratio = 16.813) showed significant difference between their mean gain scores ($M_1$ = 5.94, $M_2$ = 2.79). This data thus emphasizes the superiority of IPM group over AOM group. [Vide table 5.54].

The analysis of covariation of the pre test and post test scores of mathematics attitude of pupils in the IPM and AOM groups showed significant difference between the two groups ($F_{y.x} = 281.47$, $P<0.01$). [Vide table 5.56].

The difference between the adjusted means of the two groups showed the IPM group performed significantly higher than the control group. ($t = 16.79$, $P<0.01$). [Vide table 5.57].

6.3 Tenability of Hypotheses

The tenability of the hypotheses may be tested based on conclusions arrived at from the data collected. The analysis of the data suggests that the hypotheses formulated remain substantiated.

Hypothesis (1) states that The Total Achievement in Mathematics of secondary school students when taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

This hypothesis is fully substantiated since the t value calculated is significant at 0.01 level ($t = 27.02; P < 0.01$).

Hypothesis (2) states that the Objective Wise Achievement of secondary school students in Mathematics when taught using
Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

This hypothesis is fully substantiated since the t value calculated is significant at 0.01 level for each category of objective.

- Knowledge: $t = 4.85; P < 0.01$
- Comprehension: $t = 3.88; P < 0.01$
- Application: $t = 4.70; P < 0.01$
- Analysis: $t = 5.03; P < 0.01$
- Synthesis: $t = 6.43; P < 0.01$
- Evaluation: $t = 5.18; P < 0.01$

Hypothesis (3) states that The Problem Solving Ability of secondary school students when taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

This hypothesis is fully substantiated since the t value calculated is significant at 0.01 level ($t = 16.79; P < 0.01$).

Hypothesis (4) states that the Mathematical Interest of secondary school students taught using Information Processing Models is significantly higher than that of students taught using the Activity Oriented Method.

This hypothesis is fully substantiated since the t value calculated is significant at 0.01 level ($t = 8.77; P < 0.01$).

Hypothesis (5) states that the Mathematical Attitude of secondary school students taught using Information Processing Models is
significantly higher than that of students taught using the Activity Oriented Method.

This hypothesis is fully substantiated since the t value calculated is significant at 0.01 level \( t = 4.23; P < 0.01 \).

6.4 Conclusions of the Study

The conclusions arrived at in the present study are the following:

**Conclusion 1:** Instruction given using the Information Processing Model is superior to the instruction given using the Activity Oriented Method with respect to Total Achievement in Mathematics. This conclusion has been arrived at based on the finding no. 6.2.1.

**Conclusion 2:** Instruction given using the Information Processing Model is superior to the instruction given using the Activity Oriented Method in the Achievement of Mathematics with respect to Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation levels. This conclusion has been arrived at based on the findings 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.2.6, and 6.2.7.

**Conclusion 3:** Instruction given using the Information Processing Model is superior to the instruction given using the Activity Oriented Method in developing Problem Solving Ability in secondary school students. This conclusion has been arrived at based on the finding no. 6.2.8.
Conclusion 4: Instruction given using the Information Processing Model is superior to the instruction given using the Activity Oriented Method in developing Mathematical Interest in secondary school students.

This conclusion has been arrived at based on the finding no. 6.2.9.

Conclusion 5: Instruction given using the Information Processing Model is superior to the instruction given using the Activity Oriented Method in developing Mathematical Attitude in secondary school students.

This conclusion has been arrived at based on the finding no. 6.2.10.

6.5 Suggestions for Improving Educational Practices

It was emphatically proved from the study that the application of Information Processing Model was far superior to the Activity Oriented Method in teaching Mathematics. The following suggestions are arrived at based on the findings of the study.

1. The Information Processing Model should be introduced in the secondary school level for the development of mathematical interest and mathematical attitude in pupil

2. The Information Processing Model should be used for the development of problem solving ability in the secondary school.

3. Faculty improvement programmes namely, Orientation Classes, Refresher Courses, Seminars and Workshops should be organised for the teachers to familiarise with various instructional strategies such as Information Processing
Model. Simple books based on models of teaching should be published in mother tongue.

4. Model lesson transcripts based on different models of teaching on selected units may be developed by an expert team and made available to teachers.

5. Usually the teacher trainees are not getting proper exposure to innovative approaches to teaching. Hence provisions should be made in teacher education programmes to give them proper training in innovative approaches.

6. Since suitable library / reference facilities are not available in secondary school for practicing innovative methods, they should be equipped with suitable library / reference facilities including reading materials and supplementary materials on models of teaching.

7. Since overcrowded class rooms and difficulty in maintaining discipline are two practical difficulties likely to be encountered by teachers while practicing the Information Processing Models, steps must be taken to revise the teacher-pupil ratio by reducing the number of students in the class.

8. The classes using Activity Oriented Method can also be improved if the activities in it are restructured, adopting an essence of different models of teaching wherever possible.
9. The incorporation of models of teaching in the present day Activity Oriented Method is best suited to get optimum results in our Indian context.

6.6 Suggestions for Further Research

1. Similar studies can be conducted at other educational levels and in other disciplines.

2. The study may be repeated utilizing a wider sample.

3. Similar studies can be carried out using other models of teaching which have not been attempted so far.

4. Similar studies can be conducted on exceptional learners.

5. Similar study can be conducted on tribal students and students belonging to coastal area.

6. The study can be repeated in bilingual students.

7. The investigation can be done to find the problems behind implementing the methods of teaching.

8. Teaching materials to orient mathematics curriculum to adapt this technique of teaching can be prepared and tested.

9. Experiments of longer duration can be conducted.

10. Similar studies can be conducted using different combination of models from different families.