CHAPTER V
SUMMARY AND CONCLUSIONS

In this present investigation an attempt was made to study Achievement of Industrial Education students learning through programmed instruction in different styles (Computer Assisted Instruction, CAI and Overhead Projector, OHP) in relation to Instructional Design, Achievement Motivation and Personality Types.

This chapter contains a summary of total investigative activities, statement of the problem, objectives, hypotheses, design of the study as well as sample and tools used in the study. This chapter also includes the main findings of the present study and suggestions for further research in this area.

5.1 STATEMENT OF THE PROBLEM

The title of the present study may be stated as follows:

"An Investigation into the Achievement of the Industrial Education Students of Thailand in Taxonomic Categories in Relation to Instructional Design, Achievement Motivation and Personality Types"

5.2 OBJECTIVES OF THE STUDY

The following objectives have been formulated for the present study:

1. To study the effect of Instructional Design on the Achievement of the students in Taxonomic Categories of Knowledge, Comprehension, Application and on the Total of Taxonomic Categories.

2. To work out the effect of Achievement Motivation on students' Achievement in Taxonomic Categories of Knowledge, Comprehension, Application and Total of these Taxonomic Categories.
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3 To find out the effect of Personality Types on students’ Achievement in Taxonomic Categories of Knowledge, Comprehension, Application and on the Total of Taxonomic Categories.

4 To study the interaction effects of Instructional Design, Achievement Motivation and Personality Types on the Achievement of the students in Taxonomic Categories of Knowledge, Comprehension, Application and the Total of Taxonomic Categories.

5 To study the intercorrelations among the variables of Instructional Design, Achievement Motivation, Personality Types and Academic Achievement in three areas of Bloom’s Taxonomic Categories and Total Academic Achievement.

5.3 HYPOTHESES OF THE STUDY

The hypotheses formulated for the present investigation are as follows:

1 The group learning through CAI will perform better in Achievement than the group learning through OHP in Knowledge, Comprehension, Application and Total of Taxonomic Categories.

2 High Achievement Motivation group will perform better in Achievement in all the Taxonomic Categories and the Total of Taxonomic Categories than the group with Low Achievement Motivation.

3 There will be no significant differences in the Achievement of Extrovert & Introvert students in the various Taxonomic Categories and the Total of Taxonomic Categories.

4 The interaction of the variables of Instructional Design, Achievement Motivation and Personality Types would significant on Achievement in three Taxonomic Categories as well as on the Total of Taxonomic Categories.
5 The intercorrelations among the variables of Instructional Design, Achievement Motivation, Personality Types and Achievement in the three Taxonomic Categories and their Total will be positive and significant.

5.4 DESIGN OF THE STUDY

The study was experimental in nature. A factorial design was used to conduct the study. The lay-out of the experimental in the study was based on 2 x 2 x 2 factorial design as given below:

Fig 5.1 Lay Out of the Design

\[ A_1 \] \[ A_2 \]
\[ P_1 \] \[ P_2 \]
\[ I_1 \] \[ I_2 \]

The 2 x 2 x 2 factorial design was replicated four times by taking scores on each of Taxonomic Categories of Knowledge, Comprehension, Application and Total Academic Achievement scores as dependent variables for each replication.

5.5 SAMPLE

The sample for the present study consisted of 1,440 students. The sample was drawn from three technical colleges in northern part of Thailand in different stages. The sampling was done as given below:
Stage 1: Three technical colleges were randomly selected from the 16 technical colleges in the northern region of Thailand. 600 students were randomly selected from the three technical colleges for the study.

Stage 2: Thus, the sample consisted of 600 students from three technical colleges (diploma level). The formation of High and Low groups on the variable of Achievement Motivation was done by Kelley's (1939) criterion of taking top 27% and bottom 27% students forming the High and Low groups.

Stage 3: The criterion of Mean ± 0.50 SD was used for classifying students into Introverts and Extroverts on the variable of Personality Types. The sample for analysis in the 2 x 2 x 2 factorial design was randomly chosen in equal number of 15 students in each of 8 treatment combinations. Therefore, the total sample for final analysis consisted of 120 students in the 2 x 2 x 2 factorial frame of reference.

5.6 TOOLS

The following tools were used for collecting data:

4. Transparencies for OHP developed by investigator.
5. Achievement test developed by investigator.

5.7 ANALYSIS OF DATA

The following statistical techniques were used to analyse the data:

1. Mean scores were calculated to study the Academic Achievement in three Taxonomic Categories classified by the independent variables of Instructional Design, Achievement Motivation and Personality Types.
2 Analysis of variance technique was applied to determine the main and interaction effects of these factors viz. Instructional Design, Achievement Motivation and Personality Types upon the Academic Achievement in three areas of Bloom's Taxonomic Categories and the Total Academic Achievement.

3 Intercorrelations were computed in order to see the extent of relationships among variables.

5.8 CONCLUSIONS

5.8.1 Mean Score

- For Instructional Design, the mean score of Academic Achievement of students learning through CAI is higher than the students learning through OHP in each of the Taxonomic Categories and in the Total Academic Achievement.

- For Achievement Motivation, the mean score of Academic Achievement of High Achievement Motivation group is higher in each of the Taxonomic Categories and also in the Total Academic Achievement than that of Low Achievement Motivation group.

- For Personality Types, the mean score of Academic Achievement of Introvert students' group is higher in the areas of Knowledge, Application and Total Academic Achievement than that of Extrovert students' group. The mean score of Extrovert students' group is higher than that of the Introvert students' group in the area of Comprehension.

5.8.2 Main Effects

Significant differences in Achievement exist among variables for the groups of students in different Taxonomic Categories pertaining to Knowledge, Comprehension, Application and the Total Academic Achievement as given below.
• The mean square of Instructional Design (I) corresponds to a comparison between the means of scores for Computer Assisted Instruction (I₁) and Overhead Projector (I₂) averaged over two levels each of Achievement Motivation and Personality Types.

  - Main Effect of Instructional Design on Academic Achievement in the area of Knowledge

    The F-ratio for Instructional Design (I) is 0.26 and is found to be non-significant even at .05 level of confidence. The mean for I₁ (CAI) is 32.28 and the mean for I₂ (OHP) is 31.81. It shows that the means of I₁ and I₂ do not differ significantly over two levels each of Achievement Motivation and Personality Types. This indicates that students learning through CAI and OHP are equally benefited in Academic Achievement in the area of Knowledge.

  - Main Effect of Instructional Design on Academic Achievement in the area of Comprehension

    The F-ratio for Instructional Design (I) is 0.70 and is found to be non-significant even at .05 level of confidence. The mean for I₁ (CAI) is 10.73 and the mean for I₂ (OHP) is 10.18. It shows that the means of I₁ and I₂ do not differ significantly in the area of Comprehension. This indicates that the two modes of Instructional Design of CAI and OHP exhibit nearly the same Academic Achievement in the area of Comprehension.

  - Main Effect of Instructional Design on Academic Achievement in the area of Application

    According to the F-ratio for Instructional Design (I) is 5.04 which is significant at .05 level of confidence. It means that the means of I₁ and I₂ differ significantly. The mean for I₁ is 6.93 and the mean for I₂ is 6.00. It shows a difference
of 0.93 per-subject in favour of I₁, therefore it is concluded that the CAI is superior to the OHP instruction in the area of Application.

- **Main Effect of Instructional Design on Total Academic Achievement**

  The F-ratio for Instructional Design (I) is 0.80 and is found to be non-significant even at .05 level of confidence. The mean for I₁ (CAI) is 49.65 and the mean for I₂ (OHP) is 48.06. It shows that the means of I₁ and I₂ do not differ significantly on Total Academic Achievement. This indicates that the students learning through CAI and OHP are equal on Total Academic Achievement.

  In case of the effect of Instructional Design which is composed of two levels designated as I₁ and I₂ on Academic Achievement in Bloom's Taxonomic Categories in the areas of Knowledge, Comprehension, Application and the Total of three Taxonomic Categories; F-ratios for the main effects of Instructional Design on the Academic Achievement of students in three Taxonomic Categories and Total Academic Achievement are 0.26, 0.70, 5.04 and 0.80 respectively. There are significant differences between I₁ and I₂ in the area of Application and non-significant differences in areas of Knowledge, Comprehension and Total Academic Achievement.

- **The main effects of two levels of Achievement Motivation for High (A₁) and Low (A₂) groups were analysed over two levels each of Instructional Design and personality Types.**

- **Main Effect of Achievement Motivation on Academic Achievement in the area of Knowledge**

  The F-ratio for Achievement Motivation (A) is 0.59 and is found to be non-significant even at .05 level of confidence. The mean for A₁ is 32.40 and the mean for A₂ is 31.70. It shows the means of A₁ and A₂ do not differ significantly over
two levels each of Instructional Design and Personality Types in the area of Knowledge. Thus, it shows that High and Low Achievement Motivation groups are nearly similar in achievement in the area of Knowledge.

- **Main Effect of Achievement Motivation on Academic Achievement in the area of Comprehension.**

  The F-ratio for Achievement Motivation which is 5.82 is significant at .05 level of confidence. It means that the means of $A_1$ and $A_2$ differ significantly over two levels each of Instructional Design and Personality Types. The mean for $A_1$ is 11.25 and the mean for $A_2$ is 9.66. It shows a distinct difference of 1.59 per-subject in favour of $A_1$. So, it is concluded that High-Achievement Motivation group is superior to the Low-Achievement Motivation group in the area of Comprehension.

- **Main Effect of Achievement Motivation on Academic Achievement in the area of Application.**

  The F-ratio for Achievement Motivation is 6.58 and is significant at .05 level of confidence. It means that the means of $A_1$ and $A_2$ differ significantly over two levels each of Instructional Design and Personality Types. The mean for $A_1$ is 7.00 and the mean for $A_2$ is 5.93. It shows a distinct difference of 1.07 per-subject in favour of $A_1$. So, it is concluded that High-Achievement Motivation group is superior to the Low-Achievement Motivation group in the area of Application.

- **Main Effect of Achievement Motivation on Total Academic Achievement.**

  The F-ratio for Achievement Motivation is 0.80 and is found to be non-significant even at .05 level of confidence. The mean for $A_1$ is 49.65 and the mean for $A_2$ is 48.06. It shows that the means of $A_1$ and $A_2$ do not differ significantly
on Total Academic Achievement. This indicates that High and Low Achievement Motivation groups are nearly similar on Total Academic Achievement.

In case of the effect of Achievement Motivation which comprises two levels A₁ and A₂ on Academic Achievement in Bloom's Taxonomic Categories in areas of Knowledge, Comprehension, Application and the Total of three Taxonomic Categories, F-ratios for the main effects of Achievement Motivation of students in three Taxonomic Categories and for the Total Academic Achievement are 0.59, 5.82, 6.58 and 0.80 respectively. There are significant differences between A₁ and A₂ in the areas of Comprehension and Application and the differences are not significant in the areas of Knowledge and Total Academic Achievement.

- The mean square of Personality Types (P) comparison between the means of scores for Introvert (P₁) and Extrovert (P₂) students averaged over two levels each of Instructional Design and Achievement Motivation.

  - **Main Effect of Personality Types on Academic Achievement in the area of Knowledge**

    The F-ratio for Personality Types (P) is 0.02 and is found to be non-significant even at .05 level of confidence. The mean score for P₁ is 32.11 and for P₂ is 31.98. It shows a difference between mean scores of P₁ and P₂ as 0.13 per-subject in favour of P₁. It reveals that means of Introvert and Extrovert students do not differ significantly and exhibit the same achievement in the area of Knowledge.

  - **Main Effect of Personality Types on Academic Achievement in the area of Comprehension**

    The F-ratio for Personality Types (P) is 0.0007 and is found to be non-significant even at .05 level of confidence. The mean score for P₁ is 10.45 and for P₂ is 10.46. It shows a difference between mean scores of P₁ and P₂ as 0.01 per-subject in
favour of $P_2$. It reveals that means of Introvert and Extrovert students do not differ significantly and exhibit the same achievement in the area of Comprehension.

- **Main Effect of Personality Types on Academic Achievement in the area of Application**

  The F-ratio for Personality Types ($P$) is 0.41 and is found to be non-significant even at .05 level of confidence. The mean score for $P_1$ is 6.60 and for $P_2$ is 6.33. It reveals that the means of $P_1$ and $P_2$ do not differ significantly over two levels each of Instructional Design and Achievement Motivation. This indicates that Introvert and Extrovert students show equal Achievement in the area of Application.

- **Main Effect of Personality Types on Total Academic Achievement**

  The F-ratio for Personality Types ($P$) is 0.0007 and is found to be non-significant even at .05 of confidence. The mean for $P_1$ is 48.88 and the mean for $P_2$ is 48.83. It shows a difference of 0.05 per-subject in favour of $P_1$. It means that the means of $P_1$ and $P_2$ do not differ significantly on Total Academic Achievement.

  This indicates that Introvert and Extrovert students groups are nearly similar in Achievement on Total Academic Achievement.

  For the effect of the level of Personality Types ($P$) for Introvert ($P_1$) and Extrovert ($P_2$) students on Academic Achievement in Bloom's Taxonomic Categories in areas of Knowledge, Comprehension, Application and the Total of three Taxonomic Categories, the F-ratios of the main effects of this variable on Academic Achievement of students in three Taxonomic Categories and total of Academic Achievement are 0.02, 0.0007, 0.41 and 0.0007 respectively.

  There are non-significant differences between $P_1$ and $P_2$ in the areas of Knowledge, Comprehension, Application and Total Academic Achievement.
5.8.3 Interaction Effects

The double interaction effects of Instructional Design x Achievement Motivation (I x A), Instructional Design x Personality Types (I x P), Achievement Motivation x Personality Types (A x P) and triple interaction effect of I x A x P (Instructional Design x Achievement Motivation x Personality Types) in respect of Academic Achievement in Bloom's Taxonomic Categories of Knowledge, Comprehension, Application and Total of three Taxonomic Categories were analysed by means of analysis of variance technique.

The two-way interaction effects of I x A (Instructional Design x Achievement Motivation) and A x P (Achievement Motivation x Personality Types) on Academic Achievement in areas of Knowledge, Comprehension, Application and Total of three Taxonomic Categories are not found to be statistically significant even at .05 level of confidence. It means that Instructional Design (I) effect is independent of Achievement Motivation (A) and Achievement Motivation (A) effect is also independent of Personality Types (P). The difference between two levels of Instructional Design (I<sub>1</sub> and I<sub>2</sub>) is not dependent upon the levels of Achievement Motivation (High and Low). The statement about the difference between the levels of Achievement Motivation (A<sub>1</sub> and A<sub>2</sub>) is also independent of the levels of Personality Types of Introvert and Extrovert students.

The F-ratios for interaction effect of Instructional Design x Personality Types (I x P) in the areas of Comprehension and Total Academic Achievement are 16.71 and 8.40 which are significant at .05 level of confidence.

It means that Instructional Design (I) effect is not independent of Personality Types (P). The difference between two levels of Instructional Design (I<sub>1</sub> and I<sub>2</sub>) is dependent upon the levels of Personality Types (P<sub>1</sub> and P<sub>2</sub>) in the areas of Comprehension and Total Academic Achievement.
The triple interaction among the variables of Instructional Design x Achievement Motivation x Personality Types (IxAxP) on Academic Achievement in Knowledge, Comprehension, Application and Total of three Taxonomic Categories is not found to be significant at any level of confidence. This points out that the Instructional Design, Achievement Motivation and Personality Types together do not interact with one another in a three-way interaction to produce significant effect on Academic Achievement.

Thus, the conclusion drawn from this discussion is that the treatment effect of the variables of Instructional Design, Achievement Motivation and Personality Types on Academic Achievement in three areas of Bloom's Taxonomic Categories, namely Knowledge, Comprehension, Application and Total of three Taxonomic Categories is independent from each other except in case of Instructional Design x Personality Types (I x P). The Academic Achievement is affected by the interaction of Instructional Design (I) and Personality Types (P) in the areas of Comprehension and Total Academic Achievement.

5.8.4 Intercorrelations

The intercorrelations among the variables of Instructional Design, Achievement Motivation, Personality Types and Academic Achievement Bloom's Taxonomic Categories in the areas of Knowledge, Comprehension, Application and Total of all Taxonomic Categories have been concluded in groups as detailed Below:

- Introvert students learning through OHP have positive and significant correlation between Achievement Motivation and Academic Achievement in the area of Total Academic Achievement
- Introvert students learning through OHP have positive and significant correlation between Knowledge and Total Academic Achievement
• Introvert students learning through OHP have positive and significant correlation between Comprehension and Total Academic Achievement
• Introvert students learning through OHP have no significant correlation between Knowledge and Comprehension
• Introvert students learning through OHP have no significant correlation between Knowledge and Application
• Introvert students learning through OHP have no significant correlation between Comprehension and Application
• Introvert students learning through OHP have no significant correlation between Application and Total Academic Achievement
• Extrovert students learning through OHP have positive and significant correlation between Achievement Motivation and Academic Achievement in the area of Total Academic Achievement
• Extrovert students learning through OHP have positive and significant correlation between Knowledge and Comprehension
• Extrovert students learning through OHP have positive and significant correlation between Knowledge and Total Academic Achievement
• Extrovert students learning through OHP have positive and significant correlation between Comprehension and Total Academic Achievement
• Extrovert students learning through OHP have no significant correlation between Knowledge and Application
• Extrovert students learning through OHP have no significant correlation between Comprehension and Application
• Extrovert students learning through OHP have no significant correlation between Application and Total Academic Achievement
• Introvert students learning through CAI have positive and significant correlation between Achievement Motivation and Academic Achievement in the area of Total Academic Achievement

• Introvert students learning through CAI have positive and significant correlation between Knowledge and Total Academic Achievement

• Introvert students learning through CAI have positive and significant correlation between Comprehension and Application

• Introvert students learning through CAI have positive and significant correlation between Comprehension and Total Academic Achievement

• Introvert students learning through CAI have no significant correlation between Knowledge and Comprehension

• Introvert students learning through CAI have no significant correlation between Knowledge and Application

• Introvert students learning through CAI have no significant correlation between Application and Total Academic Achievement

• Extrovert students learning through CAI have positive and significant correlation between Achievement Motivation and Academic Achievement in the area of Total Academic Achievement

• Extrovert students learning through CAI have positive and significant correlation between Knowledge and Comprehension

• Extrovert students learning through CAI have positive and significant correlation between Knowledge and Total Academic Achievement

• Extrovert students learning through CAI have positive and significant correlation between Comprehension and Total Academic Achievement

• Extrovert students learning through CAI have no significant correlation between Knowledge and Application
• Extrovert students learning through CAI have no significant correlation between Comprehension and Application

• Extrovert students learning through CAI have no significant correlation between Application and Total Academic Achievement

5.9 LIMITATIONS OF THE STUDY

The applicability of the generalizations of the present study will be determined by the similarity of the conditions between the populations. Though the data are collected empirically and are analysed by statistical methods yet certain errors might have remained undiscovered during the conduct of the study. The findings could be better interpreted by taking the sampling errors into consideration according to the laws of probability.

5.10 EDUCATIONAL IMPLICATIONS

The results of the present study have great utility for the teachers & students, guidance workers, educators and administrators etc.

On the basis of results the present study following implications can be drawn:

- In the present study, the CAI and OHP are equally effective for achievement in areas of Knowledge and Comprehension whereas CAI can be used with advantage for achievement in the area of Application.

- The effect of Achievement Motivation on Academic Achievement suggests that High-Achievement Motivation group is better than the Low-Achievement Motivation group in areas of Comprehension and Application whereas in the area of Knowledge both groups are equal.

- For Introvert students and Extrovert students are equal in Academic Achievement or result of learning through CAI and OHP in the areas of Knowledge, Comprehension, Application and Total achievement of three Taxonomic Categories.
These results can be utilised by the teachers in maximising the instructional benefits in teaching, particularly in difficult areas and ensuring motivation through various techniques.

The guidance workers can be benefited by the Knowledge of these results and use the same for associating the Achievement with the other variables of the study for maximum benefits of the children.

The results can be utilized with advantage by the administrators of technical colleges to get Academic support since they can associate the Instructional Design with the variables of Achievement Motivation and Personality Types and can guide the students accordingly for better results in the light of variables coming under the preview of the present study.

5.11 SUGGESTIONS FOR FURTHER STUDIES

Some suggestions may be made hereby for other possibilities of research in this field:

- An experimental study may be conducted to see the effectiveness of the different study of programming viz. Power Point, Audio Recordings, Slide Projection, Linear and Branching Programmes etc. on the variables under study.

- The study may be replicated on the samples of different populations of schools, colleges and for different classes in universities.

The study may be conducted by involving more variables like Learning Approach, Self-concept, Cognitive Styles, Creativity, Intelligence and other various Personality factors which may be taken in different combinations with the variables incorporated in the present study to find out their effects on the Academic Achievement of the students by using different Instructional Designs.