CHAPTER 3

REVIEW OF THE RELATED LITERATURE
3.0 INTRODUCTION

In any research the first task of the investigator is to look into the past work done in the area in which we propose to take up research. The review of the related literature is essential for it gives insight into the problem to the investigator. Besides this, some feel that the purpose of the reviewing the literature is to show the uniqueness or the originality of the research on hand. At the same time it also help a the investigator to understand the problem in a better way so that he could try to observe the problems. Forces by the past researches in doing the researches quite satisfactory.

The importance of the review of related literature and previous researches is quite obvious. The purpose of this chapter is generally to provide a brief and initial review and appraisal of any of the related studies and to show how the present study contributes more or advanced details available in the area under study. There are a few studies done in state. The major one is described in details as follow-
3.1 **STUDIES ON DEVELOPMENT OF CAI**

The reviews of the studies regarding maths achievements due to Computer Assisted Instruction programmes have been made through all the necessary phases of Research Methodology.

**STUDY 1 Effects of Computer-assisted Mathematic Instruction as Disadvantaged pupils' cognitive and Affective development.**

This study was done by Schofield.

**Objectives**

1. To study cognitive and affective development of Disadvantaged pupil's of elementary school of Israel.
2. To study the main effects between and among Instruction Grade and sex.
3. To study the instruction effects between and among Instruction Grade and sex.
4. To study the corelates of Computer Assisted Instruction i.e. Instruction and Computer assisted Instruction, sex and Computer Assisted Instruction.

**Sample**

The investigator has selected participants i.e. 376 were elementary school students. In fact classes of pupils drawn from three schools in different Israeli development
tours served us, subjects in the CATI treatment. Each school was represented by one third, one fourth and one fifth grade.

Treatment

In fact classes of pupils drawn from three schools in three development towns, were exposed to traditional mathematics instruction only. In one relatively large development town, one school was assigned to the CATI condition, while another school served in the contrast group.

Computer Assisted Instruction (CAI)

CAI is instructional practice that seem to hold promise for the simultaneous investment of disadvantaged pupil's cognitive and coeffective, development. The most basic usage of computer in mathematics instruction is in the area of drill and practice as a supplement to the regular curriculum. Characteristics of CAI, such as a curriculum specially failared to the individual pupil's level and rate of achievement, immediately and accuracy of feedback corrective and multisensory modes of informational input and output, create more positive conditions for drill and practice then is possible in the typical classroom.

Computer Assisted Traditional Instruction (CATI)

This study was initiated to determine whether CAI as a supplement to traditional mathematics instruction faster gains for disadvantaged elementary school pupils in the
effective as well as academic domains.

**Tools**

The tools that were used in present study are as under:


**Results**

Results from this study, a significant difference was found between the CATI and traditional instruction groups. At all three grades, CATI pupils scored higher on arithmetic achievement, than pupils receiving traditional instruction only. An instruction by grade interaction indicates that this difference was particularly huge in fourth grade where CATI pupils reached an achievement level approximately one standard deviation higher than traditional instruction children. The achievement of boys and girls did not significantly differ nor were there any other significant interaction effects.

**Discussion**

Results from this study supported the general hypothesis that computer assisted mathematics instruction positively
affects the cognitive and effective development of disadvantaged elementary school pupils. At all three grades levels (third, fourth, fifth) pupils in the CATI condition reported more positive perceptions of school life and scored higher on mathematic achievement than did their poorer in the traditional instruction.

Results from this study lend considerable support to the assertion that CAI provides significant mathematics achievement gains for disadvantaged pupils. Furthermore, it has been demonstrated that the computer does not serve to alienate children from the school but leads disadvantaged pupils to improved perceptions of self and schooling.

**STUDY 2 Computer assisted Instruction Methods : A Factorial study within Mathematics Disadvantaged classrooms.**

This study was done by Willing, Hornisch, and Macher.

**Objectives**

1. To study mathematics disadvantaged classrooms pupils of elementary school of Israel.
2. To study the main effects between and among Mathematics Achievement and Mathematics Anxiety.
3. To study the instruction effects between and among mathematics achievement and mathematics anxiety.
4. To study the correlates of Computer Assisted Instruction i.e. Computer Assisted Instruction and achievement level Computer Assisted Instruction and Mathema-
tics Anxiety and Locus of Control and Computer Assisted Instruction.

Sample

Participants were 204 third grade children studying in four Israeli schools. Each contained two parallel third grade class-rooms. The schools served predominantly lower socioeconomic status. Facilities as defined by the Israeli Ministry of Education.

Treatment

This study design defined four treatment.

1 Individualized Instruction (II).
2 Traditionnal Instruction (TI).
3 Computer Assisted Individualized Instruction (CAII).
4 Computer Assisted Traditional Instruction (CATI).

The treatment were employed in disadvantaged third grade mathematics.

Procedure

To understand the specific contribution of CAI to Children's cognitive and personal growth the present study used a 2*2 factorial design with individualized instruction and CAI as factors.

The four intact pairs of class-rooms were exposed to the same mathematics instruction. Non CAI classrooms recei-
ved four class periods of traditional or individualized mathematics instruction, weekly while CAI groups were taught three periods weekly according to the primary method and one class period (two 20 minute sessions) with CAI.

Tools

The tools that were used by present study are as under:

1. Arithmetic Achievement Test (AAT) constructed by the Israeli Ministry of Education.
2. Intellectual Achievement Responsibility (IAR) questionnaire (Crandall et al. 1985).
3. Mathematics Anxiety was assessed by eight items adapted from Mevarech and Rich (1984).

Results

Prior to univariate analyses a two factor multivariate analysis of variance (MANOVA) was performed on measures of achievement. Anxiety and Locus of control.

1 Mathematics Achievement

Results indicated a significant main effect for CAI only.

\[ F(1, 200) = 28.84 \]

\[ P < 0.001 \]

The main effect for the individualized instruction and the interaction between three two factors were not significant.
F (1,200) = 1.37 for (II)
F 1.00 for interaction

2 Mathematics Anxiety

A two way ANOVA for mathematics anxiety scores showed significant main effects only for CAI.

F (1,200) = 9.9
P 0.001

students were less anxious than non-CAI students.

3 Locus of Control

Results indicated that CAI significantly affected causal attributions for both success and failure experiences:

F (1,200) = 16.75
P 0.001

For SR-S F(1,200) 0.82
P 0.001

For SR-S F (1,200) = 3.86
P 0.06

The difference, between individualized and traditional class-rooms were marginally significant only on SR-F.

Discussion

The present analysis support the hypothesis of a differential impact of CATI and CATI on three specific variable.
It may well be the case that differences exist on other personal variables are necessary to identify and evaluate these effects. This is particular importance, since achievement is only one aspect about a major one of CAI impact on children's growth.

**STUDY 3 The Effect of Microcomputer Assisted Instruction on the Computer literacy of fifth grade Students.**

This study was done by Kathleen J. Steele, Michael T. Battista and Gerald H. Krockoover.

**Objective**

The purpose of the present study was to investigate the effect of computer assisted instruction on the computer literacy of fifth grade students.

**Method**

The subject for the study were 86 fifth grade students. The microcomputer drill and practice (MDP) group included 51 students assigned to three intact classes. The instructors for the group did not receive any training related to computer literacy. There were no significant differences, p < .05, between the means of the two groups of teachers.

The MDP group used Math Sequences (Milliken Publishing Company, 1980), a commercially available computer assisted
drill and practice series designed for microcomputer use. It is based on the research and Computer Assisted Instructional programs designed by Patrick Suppes and others at Stanford University. The attitudes and values measured by the affective subscale were defined as follows:

- Enjoyment was defined as the degree of pleasure related to computers.
- Anxiety was defined as the level of stress attributed to computers.
- Efficacy was defined as the level of confidence exhibited by students in relation to working with computers.
- Educational computer support was defined as the attitudes relating to the use of computers in the schools.
- Value I was defined as the importance of social and personal values.
- Value II was defined as the importance on technical values.

The areas of knowledge measured by the cognitive subscale were defined as follows.

Results

Reliability of the pretest for all 86 subjects on the affective subscale was .875, on the cognitive subscale .730, and on the composite scale .780. These reliabilities were consistent with the results reported by Anderson, Klassen, Johnson and Hansen (1979).
For each scale of the MCLAA, the analysis of covariance of posttest scores using pretest scores as the covariate is presented in Table 2. Treatment affects were significant ($p < .001$) on all three scales, with the MDP group scoring higher than the CDP group in each case.

Discussion

The results of the present study indicate that computer-assisted drill and practice can significantly improve the computer literacy of fifth grade students in both the affective and cognitive domains.

Thus, while the gains in mathematical achievement did not differ, the use of CAI and a microcomputer allowed the subjects in the MDP group to make significant gains in computer literacy. Additional studies, similar to this one, using other content areas, different types of CAI, and other grade levels should be conducted to ascertain whether or not these results can be generalized. For, if similar results are obtained, the value of using microcomputer assisted instruction will be based on a solid foundation and should receive greater acceptance from the educational community.

**STUDY 4 Effects of Computer Assisted Instruction and Teacher Assisted Instruction on Arithmetic Task Achievement Scores of Kindergarten Children**
This study was done by Tonnis, McCollister, Diane C. Burts & Hildreth.

Objective

A study to test for differences in the effects of computer assisted instruction and teacher assisted instruction on numeral recognition and cardinal counting scores of preschool children.

Sample

The investigator has selected 53 kindergarten children (19 Girls, 34 Boys) who attended a public elementary school in a large southern city (USA).

Treatments

Subjects received one of two treatments, computer assisted instruction or teacher-assisted instruction. A pretest was given in order to measure numeral recognition and cardinal counting skill (1-20).

1 Computer-assisted Treatment

The Commodore 64 with the prewritten program "How Many Squares" C. Friedberg and Nickerson, 1982), was used in this study. This program was selected because it contained two levels (1-10 and 11-20) of instruction and is available to the teacher or parent who does not have computer programming.
skills.

2 Teacher-assisted Treatment

Hilton Bradley's Flannelboard Cut-Outs Flannelboard Numbers were used with a Flannelboard in the teacher-assisted treatment.

Tools

The tools that were used in present study are as under:

1. The instruments used in the pre and post-tests was a criterion-referenced test developed by Pion and Burts (1984).
2. The Commodore 64 computer with the pre-written program "How Many Squares?" was used in this study. (C. Friedberg and Nickerson, 1982).
3. Milton Bradley's Flannelboard Cut-outs and Flannelboard Numbers were used with a Flannelboard in the teacher-assisted treatment.

Results

1. Achievement

A two factor ANOVA utilizing a 2 x 3 (Treatment x Level) factorial design indicated a significant difference ($F = 4.82, P = 0.03$) in favor of computer-assisted instruction for numeral recognition (see Table 1). As reported in Table 2, no difference were found between treatments for cardinal counting. A treatment by level instruction for
numeral recognition was relatively unlikely due to chance ($F = 2.41, P = 0.10$).

A t-test revealed that there was significant improvement in posttest scores over pretest scores for both treatments for numeral recognition and cardinal counting ($P < 0.01$).

2 Anecdotal Observations

As was reported by Pine (1984), children in both treatment groups were eager to have their turn, and all of the children were generally attentive. The children in the computer treatment group were able to use the computer with relative ease and exhibited mutual consulting, cooperation, and collaboration.

Discussion

Based on the findings from Pine (1984), it was hypothesized that there would be no differences between the two groups, for either numeral recognition or cardinal counting.

Findings reported above only partially support the hypothesis. There was a significant difference in mean scores or numeral recognition tasks, in favor of the computer treatment group over the teacher treatment group.

**STUDY 5 Effects of CAI with Fixed and Adaptive Feedback on Children's Mathematics Anxiety and Achievement.**
This study was done by Zemira R. Mevarech and Sigal Ben-artzi.5

Objective

The purpose of the present study was to examine the effects of computer assisted instruction (CAI) with fixed and adaptive feedback on children's mathematics anxiety and achievement.

Method

1 Subjects

Participants (N = 245) were all sixth-grade students in three Israeli schools. One school (n = 71) had no CAI curriculum and was considered as a control group. The other two schools were selected for CAI implementation and contained either CAI with fixed feedback (n = 82) or CAI with adaptive feedback (n = 92). The schools were comparable in terms of size, sex, SES, and GPA.

2 Treatments

All three schools had in common the basic group instruction, the curriculum material, and the time allocated for mathematics instruction (the CAI groups had three weekly periods of traditional instruction and two 20-minute sessions of drill and practice at the computer, the non-CAI classrooms had four weekly periods of traditional instruction).
The CAI program selected for this study is called TQAM, the Hebrew acronym for computer assisted testing and practice. During a CAI session, students answered a random mixture of problems selected from all topics (strands). At the end of each session, the system notified the student of the number of problems correct responses. In addition, summary reports were provided for teachers and students specifying the level of performance on each strand.

With help of CAI for incorrect responses, the system’s messages were "Think again" or "Try again". To further increase the provision of positive feedback, the student summary reports indicated the number of problems answered correctly on each attempt (without mentioning the number of incorrect answers) followed by powerful reinforcement messages. When the student attained 100% mastery, the system’s message ("Superb job, Rachel!") was flashing on the screen.

Measures

1 Mathematics Anxiety

Three instruments for assessing student’s mathematics anxiety were selected for initial tryout: Mathematics Anxiety Rating Scale (MARS, Richardson & Suinn, 1972), Mathematics Attitude Scale (MAS, Aiken, 1976), and Test Anxiety Scale (TAS, Sarason, 1980). The respective eighteen values and percentages of explained variation were: 8.59, 31.8%; 2.52, 16.0%; 1.50, 9.6%; 1.16, 7.39%; .98, 6.19% and .97, 6.18%. Cron-
The Arithmetic Achievement Test (AAT), constructed by the Israeli Ministry of Education (1977), was administered to all students at the end of the school year. The 25 item test covered the behavioral objectives of the sixth grade mathematics curriculum including basic operations with fractions and decimals, measurements, and percentages. A table of specifications indicated the high content validity of the test. KR (21) reliability coefficient was .78. In addition, GPA in mathematics prior to the beginning of the study assessed the initial level of children's mathematics achievement.

**Results**

The six mathematics anxiety factors were analyzed simultaneously by a two way multivariate analysis of covariance (MANCOVA) followed by separate ANCOVA for each factor while the mathematics achievement scores were subjected to a two way univariate ANCOVA. Table 1 shows the means and standard deviations of the six math anxiety factors and achievement for the three treatment groups and the low and high anxious learners; Table 2 summarizes the results of the MANCOVA and univariate ANCOVA. The MANCOVA of the math anxiety data indicated significant main effects for the treatment, $F(12, 466) = 3.16, P < .001$ and the initial level of MA, $F(6, 233)$
The multivariate interaction was not significant, $F(6, 466) = 1.04, P > .05$.

The ANCOVA of the achievement data indicated insignificant treatment main effect, $F(2, 240) = 1.30$, and only a marginally significant effect for the initial MA levels, $F(1, 240) = 2.85, P < .09$. The Treatment * Anxiety interaction was not significant, $F(2, 240) < 1.00$. Thus, there is no indication that the CAI treatments improved mathematics achievement nor that the treatments differentially affected the high anxious learners.

Discussion

The findings of this study have several methodological and practical implications. First, it appears that mathematics anxiety factors were not only intercorelated but they were also differently affected by the instructional methods. Second, within the CAI settings the provision of adaptive or fixed feedback did not make much of a difference in children's mathematics anxiety and achievement. Finally, CAI as compared to traditional instruction landed to yield lower scores on various aspects of mathematics anxiety an outcome that may have important practical implications for school learning.

**STUDY 6** The Effect of the Locus of CAI Control Strategies on the Learning of Mathematics Rules.
This study was done by Leslie Goetzfried and Michale J. Hannafin.

Objectives

This study examined the effects of externally versus internally controlled CAI design strategies on the mathematics rule learning, retention, and efficiency of low achieving junior high students.

Methods

1 Subjects

Forty-seven seventh grade students enrolled in remedial mathematics classes participated in the study. Class placement was based on poor performance on a standardized test, the Comprehensive Test of Basic skills, which was administered 8 months before this study.

2 CAI Treatments

The instructional task selected for this study was a mathematics rule lesson concerning divisibility by two, three, and five. This content had not yet been taught to the target students. Each treatments consisted of the same basic tutorial CAI program, designed to teach the rules for divisibility by two, three, and five, and the application of these rules to five and six digit numbers. The lesson structure
was based on the "Events of Instruction" and adapted to CAI (Gagne, Wager, & Rojas 1981). Three versions reporting different CAI design strategies were developed.

3 Procedures

At the conclusion of the lesson the elapsed time was noted and the immediate post test was administered. One week later students were given the parallel retention test in their classroom. This study used a 3*2*2 between subject factorial design with two additional within subject factors. Rule recall and application data as well as learning efficiency data, were analyzed using MANOVA procedures for repeated measures designs. ANOVA procedures were used to examine effects for differences in time on task. Comparisons among treatment means were accomplished using Newman Keuls pairwise contrast procedures.

Results

A significant difference in instructional time was found for CAI strategy, $F(2,38) = 15.80$, $P < .01$. Below average students scored higher across both the externally controlled adaptive strategy, $P < .05$, and the learner advisement strategy, $P < .01$. A significant effect was again detected for prior achievement, $F(1,38) = 4.88$, $P < .05$. Below average students used less time to complete treatments than low achievement students. Learning efficiency were found for CAI strategy, $F(2,34) = 6.41$, $P < .005$. The linear control stra-
strategy strategy was the most efficient (.70 concepts/minute), followed by the adaptive strategy (.51 concepts/minute), and the learner control with advisement strategy (0.38 concepts/minute). Although more efficient than low students, F (1.34) = 18.22, P < .0005, below average students were proportionately better on applications, F (2,34) = 3.64, P < .05.

Discussion

Although achievement differences resulting from the various design strategies were not found both instructional time and the associated learning efficiency were affected significantly. These are important dimension and they represent a departure from the manner in which CAI learning issues are typically studied. Perhaps future attempts to study the effects of CAI and other instructional delivery systems will move closer still to the merging of empirical and practical concerns.

STUDY 7 Achievement in Basic Math Skills for Low Performing Students: A Study of Teachers' Affect and CAI

This study was done by Barbara McGregor Moore.

Objectives

This study investigated the effects of math instruction (with and without CAI) and the influence of teachers' personalities (rated positive and negative) on the achievement of remedial math students.
Method

The subjects in this study were 177 seventh and eighth-grade students in the lowest level of remedial math at four different middle schools. Nearly half of the students were mainstreamed special education students who experienced a range of learning disabilities. The other students were regular education pupils who scored at least 3 years below grade level in basic math skills. The instrument consisted of 25 items including whole number operations, fractions, decimals, percentages and equations. The students who were placed in remediation classes were randomly assigned to 12 different classes. Six of these classes used CAI as a major portion of instruction. Six of the classes were taught strictly from a text-book. The classes ranged in size from 12 to 18 students with one teacher and the average class size was 15. The computerized program, completely individualized for each student, gave immediate feedback by problem with a daily student log and daily print out of success rate. First, the class worked through problems with the teacher, then on their own with teacher guidance. Finally, the students were assigned independent practice as homework.

Results

The effects of CAI and teacher’s affect were examined by analyzing post-test scores. Analysis of covariance was administered to assess the differences in posttest scores
between CAI and no CAI, scores between positive and negative teachers, and possible interaction between the factors (CAI and affect).

All treatments were effective to some degree; however, Group 1 (CAI and positive affect) achieved the highest scores. The use of computers and teachers' positive affect produced the best achievement. The observations of these classed validate the new relationship among students and teachers as natural partners. However, technology alone does not seem to be as effective. Group 2 (CAI and negative affect) did not match the achievement of Group 3 (no CAI and positive affect).

An ANCOVA resulted in an F value of 3.53 (P > .05) for the instructional method and an F value of 74.52 (p < .000) for the affect of the teachers. There were no significant interactions. This indicates that affect of teachers was significant with or without CAI. This shows a cross-section of posttest results.

<table>
<thead>
<tr>
<th></th>
<th>CAI</th>
<th>No CAI</th>
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<tbody>
<tr>
<td>Positive Affect</td>
<td>16.73</td>
<td>14.32</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>10.41</td>
<td>9.26</td>
</tr>
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</table>

This suggests that the attitudes, expectations, and interpersonal interactions of teachers may be more powerful on
student learning than simply adding computer assisted instruction. However, even with a negative teacher, CAI produced better results than instruction without it.

Discussion

The results of this study show that the achievement scores of students who had positive teachers were significantly different from those in negative classes. Students who received CAI showed more improvement than those who did not. For the last 25 years, authors have expressed concerns that "teaching machines" would replace teachers or at least change their roles (Broudy, 1962), and many programs have been developed that may "be less expensive and more practical than having a good teacher" (Yang, 1987, p. 14). This causes some teachers to doubt their effectiveness or influence on students. It is encouraging to note that teachers are validated in their importance, even above the use of computers.

STUDY 8 Effects of Computer-managed Instruction on Teachers
Implementation of Systematic Monitoring Programs and Student Achievement

This study was done by Lynn S. Fuchs.

Objectives

This study explored effects of (a) computerizing the data management and progress-monitoring process, and (b) those
data bases for the purpose of developing effective instructional programs.

Method

Teachers subjects were 18 female special education teachers in seven schools in one southeastern metropolitan school district, who had volunteered to participate in a study in which they would receive ongoing training. Student, each of these 18 special education teachers selected for participation two mildly handicapped male students, each of whom had an explicit and current goal in spelling. The school system had identified and labeled pupils according to the following regulations.

Two way analyses variance (computer vs. non computer and DU-Goat vs. DU-Exp) conducted on students chronological age years of special education experience revealed no significant differences. Test spelling ranges between .73 and .93 (Deno et al. 1980). Test retest reliability was found to be at least 92 (Fuchs, Deno & Harston, 1983), and intercourse agreement, assessed on 38% for words correct and 97% for letter sequences.

Within the computer group, teachers using the experimental data utilization strategy received feedback as follows:

(a) A graphed display of the pupil's performance over time appeared.

(b) A line of best fit was shown superimposed over the
most recent 7 data points.

(c) If the application of the data utilization rule indicated a progress rate less than 2.0 letter sequences improvement per week, a message appeared "Make a major program change."

(d) If the application of the rule indicated a progress rate equal to or greater than 2.0 letter sequences improvement per week, a message papered, "Make a minor program change."

Results

The multivariate analysis of variance was conducted on the two WST scores. Wilks' lambda criterion was used to test the equality of group centuries. The values calculated with the Wilks' lambda procedure were transformed into F values through Rao's approximation (Cooley & Lohnes, 1962). The tests for lambda produced the following F values: for the computer main effect, $F(2, 13) = 1.17, ns$ ; for the data utilization main effect, $F(2, 13) = 4.73, p < .05$ ; and for the interaction between the computer and data utilization factors, $F(2, 13) = 3.98, p < .05$. Means and standard deviation for the WST scores are presented in Table 3. The statistically significant between the data utilization group on the total MAIRS groups was associated with an effect size magnitude of 1.11. The difference between the goal based and experimental data utilization groups within the computer group on item 11 was associated with an effect size magnitu-
Finally, product moment correlations between the fidelity of treatment and achievement measures were run. For the WST words correct score, correlations with the MAIRS total and Item 11 scores, respectively, were .53 and .51. Each of these correlations was statistically significant (P < .05).

Discussion

As findings of this study indicate, additional systematic research, exploring dimensions of computer programs that improve teachers' accurate and systematic use of pupil progress data, may be essential for developing computer managed instruction applications capable of realizing improved teacher management and greater student achievement.

STUDY 9 Intrinsic Orientation Profiles and Learning Mathematics in CAI Settings

This study was done by Zemira R. Mevarch.

Objective

The present study investigated the differential roles of intrinsic orientation profiles in predicting mathematics achievement of students exposed to computer assisted instruction (CAI).

Method
All fourth through sixth-grade pupils (N = 257) in two Israeli schools participated in the present study. The sample consisted of four classrooms from each grade level (fourth grade, n = 89; fifth grade, n = 83 and sixth grade, n = 85). Both the aromatics achievement test (AAT) and the TOME computer testing procedure were used to assess students mathematics achievement at the end of the school year. The KR (21) reliability coefficients of the AAT were .87, .85 and .81 for fourth, fifth and sixth grades, respectively; the TCT test-retest reliability coefficients were .89, .82, and .96 for fourth, fifth, and sixth grades, respectively.

Results

To investigate the research question, the study used a 2×2×3 multivariate analysis of covariance (MANCOVA) with two dependent variables the AAT and TCT scores. The MANCOVA showed that the motivational component exerted a significant main effect (F(2,243) = 5.30, P < .006) while the cognitive informational component did not (multivariate F(2,243) = 1.92, P > .05). At all three grade levels, the achievement levels of the intrinsically motivated children were higher than those of the extrinsically motivated subjects, but the difference was significant only on the TCT (univariate F(2,243) = 8.57, P < .005). Although the multivariate cognitive informational main effect was not statistically significant, F(2,243) = 2.06, P > .05, the follow up analyses indicated a marginally significant univariate main effect on
the AAT. Evidently the intrinsically cognitive oriented pupils tended to score higher on the AAT than the extrinsically cognitive oriented children, $F(1, 243) = 3.48, P < .06$, but no significant difference was found between the two groups on the TCT scores, $F(1, 243) = 2.03, P > .05$. The interaction between the cognitive component and the grade level was not significant, $F(4, 486) < 1.00, P > .05$. Table 2 shows significant univariate interaction with regard to performance assessed by computer, $F(1, 243) = 4.23, P < .05$.

Plotting the mean scores of the Motivation * Cognitive components indicates an ordinal interaction within the intrinsically cognitive oriented group, the difference between the two motivated groups was almost twice the difference within the extrinsically cognitive oriented group. The three-way interaction was not significant, $F(4, 4588) < 1.00, P > .05$.

Discussion

The results of this study showed that intrinsically motivated student performed better (relatively speaking) at the computer but not on the paper and pencil achievement test than the extrinsically motivated children. The findings of this study have several implications for future research. The first learning processes that mediate students' orientation profiles and achievement in CAI settings.
STUDY 10  *Socioeconomic Status, Aptitude, and Gender Differences in CAI Gains of Arithmetic.*

This study was done by Nira Hativa & Dvora Shorer. 10

**Objective**

The objectives of the present study were to compare the CAI performance of advantaged versus disadvantaged students, of high-aptitude versus low-aptitude students, and of boys versus girls.

**Method**

The CAI system involved in the present study, named TOAM. The TOAH system consists of a minicomputer and 40 terminals used concurrently by all students in a class. The TOAH's diagnosis is administered through twelve 10-min diagnostic sessions during the first 3 weeks of each school year. The weekly printed report of a class's CAI performance lists for each student the level of practice in each arithmetic strand and the mean level across all strands practiced by the student.

The two schools were defined by the Israel Minister of Education as "disadvantaged" and "advantaged" schools, respectively. The criterion for defining the SES standing of an individual students is based on a weighted measure of three demographic characteristics: father's level of education (hierarchical categories); father's cultural origin (country of the father's birth, two categories: either Western or Eas-
tern-Asia, Africa, Arabic); and number of children in the family (seven categories). This weighted measure assumes values ("eligibility points") from 0 through 2.4. A student is defined as "advantaged" if this number is 0 and as "disadvantaged" if this number is greater than 0. A school is defined as disadvantaged by the Ministry of Education if it serves at least 80% of disadvantaged students (as defined above). Otherwise, the school is advantaged.

Analysis

The students' level of CAI performance at the initial stage of this study (i.e. at the beginning of the third grade) was chosen to serve as the criterion for aptitude. I compared the CAI performance of the two extreme aptitude groups in this study throughout the 4 years of data collection, within the two SEC populations. I provide descriptive of the CAI levels in Table 2, along with the gains in CAI levels during each academic year.

1 Effects of Aptitude on CAI Performance

As expected the data in Table 3 reveal the existence of the main effects of attitude in CAI levels. High achievers, in accordance with the method by which they have been identified, function data higher CAI levels than low achievers. In the fourth grade, these differences were, relatively, 3.8 and 4.5 levels. Significant interaction of Yearly Gains x Gender (Tables 4 and 5, Figure 2ed) indicate that the gap
between boys and girls in yearly gains grew significant when advancing from the third to the fourth grade.

2 Interactions of Gender X SES in CAI Performance

The interactions of SEC X Gender and of Yearly Gains X SES X Gender were not signify(see Table 5). That is, girls behave similarly to boys within both SES groups in CAI levels as well as in yearly gains. In summary, advantaged students or boys seem to function at higher levels and gain more in CAI practice than disadvantaged students or girls. The gap between each pair of groups seems to grow with increased grade level.

3 CAI Performance Reduced to Different Strands

In 27 of the 33 (11 x 3) comparisons, advantaged students performed better than the disadvantaged students, high achievers than low achievers, and boys better than girls. The data in Table 6 show that in Stands 1 and 6 (number concepts and equations), in which the great majority of students practiced throughout the 2 years period, all three difference between the two components of a comparison were statistically signified in the direction already identified. The most impressive discrepancy in performance occurred between the two SEC groups. Advantaged students performed better than the disadvantaged on 10 of the 11 strands.

In all strands, excluding the three horizontal computations, these difference were significant.
Discussion

This study identified significant difference in students' performance in CAI levels and the gains attached from CAI use on the basis of SEVCV, aptitude, and gender. These findings are important because they point to the widening of the gap between advantaged and disadvantaged students, between high- and low-aptitude students, and between benefit the most from the computer-based drill and practice in arithmetic are the advantaged, high achieving students. These results are unfortunate because CAI had been expected to improve school performance, particularly to the less able, academically weaker students.

According to Buch for further/future research:

There are many areas other almost no attempt has been made or even explanatory research. Among them the first instance is of the use of computer assisted or computer managed instruction or the latest form computer assisted learning (CAL). Computers are no longer just dreams. The country is already flooded with computers. The possible uses of microprocessors for instruction is a reality, now since India has already about 6,000 microprocessor systems by operation and has authorities established for facilitating the manufacturer of microprocessors. It might have great potential for literacy programmes. India has a good number of highly trained people in the area, but so far beyond a bit of data processing the computer has not been used for instructional purposes. There have been some interesting development with regard to the use of microprocessors for Tamil and attempt at machines translation etc. In institutions like the Tata Institute of Fundamental Research and the Indian Institute of Technology, Madras. Educational technologists should not shy away from computers any more because at the turn of the century it is estimated that there might be as many chips as people.
The review of the related researches helped the investigator to select the independent variables and a research method pertaining to the problem in hand.