CHAPTER IV

ANALYSIS AND FINDINGS

This chapter presents the study findings as they relate to the research questions. It begins with a description of studies selected for the meta-analysis and how study features and their corresponding categories were identified. In the next section, effect sizes obtained from the studies are presented. The overall effect size for CAI in technical education and training is then described, followed by a description of the relationship between various study features and CAI effectiveness.

Description of Studies Included in the Meta-analysis

Procedures discussed in Chapter III were followed to ensure studies used in this meta-analysis meet the stated criteria. Selected studies were further examined to exclude those that could not be used due to factors such as inadequate data and unsuitable data. A final set of 21 studies was selected that yielded 28 effect sizes. The number of subjects from these studies totaled 2969. Information about the study authors, year of study, and instructional content is presented in Table 1.

Although the selected studies varied in instructional content, their focus was on higher order learning. Three studies had a common instructional content, emphasizing the teaching of troubleshooting skills, which is a form of diagnostic problem solving (Gott, 1989; Gott, 1995; Johnson et al., 1992). Two of the three studies (Gott, 1989; Gott, 1995) were conducted in the military and examined the use of CAI to teach troubleshooting and repair of test stations for aircraft. The other of the three studies was conducted in a university and involved “an intelligent computer program that coaches students as they troubleshoot simulated aircraft electrical system faults” (Johnson et al., 1992, p. iii).

Table 1
Primary Studies Selected for This Meta-analysis

	Study	Year	Instructional content
1	Fouad & Burleson	1997	Endodontic diagnosis
2	Parchman, Ellis, Christinaz, & Vogel	1997	Electricity and electronics
3	Gokhale	1996	Building an amplifier
4	Shute & Gawlick-Grendel	1996	Problem solving in probability
5	Gott	1995	Complex troubleshooting
6	Johnson	1994	Ship damage control
7	Janniro	1993	Deception test questioning
8	Livergood	1993	Intelligent tutoring system.
9	Faryniarz & Lockwood	1992	Environmental analysis
10	Johnson et al.	1992	Complex troubleshooting
11	Shlechter et al.	1992	Leadership role-playing
12	Spotts	1992	Pneumatics
13	Yuill	1991	Critical thinking skills
14	Shute & Glaser	1990	Principles of economics
15	Kennison	1990	Military job skills
16	Shute, Glaser, & Raghavan	1989	Principles of economics
17	Buergermeister	1989	Cost control
18	Hwang	1989	Computer numerical control programming
19	Ogle et al.	1989	Soil loss (agriculture)
20	Gott	1989	Complex troubleshooting
21	Malec & Luszczak	1987	Helicopter electromechanical bladefold system

The following paragraphs describe the contents of some of the other selected studies. The study conducted by Fouad and Burleson (1997) required students to perform endodontic diagnosis. Students were required to choose "which diagnostic information is necessary, how to interpret data, and how to categorize the patients' conditions into accepted diagnostic entities that would lead to a decision on management" (p. 291). In Johnson's (1994) study, performance of students trained via a conventional equipment was compared with those trained via a computer-based equipment. "Both trainers possess the same fundamental goal of training Damage Control Assistants using simulated multiple weapon hit, Total Ship Survivability based training scenarios" (Johnson, 1994, p. 19). The main objective of instruction was to train war ship crew to contain damage of a hit ship while maintaining its capability to fight.

Instructional materials in Janniro's (1993) study were in the field of forensic science. The materials were aimed at teaching students to construct appropriate questions that are neither too broad nor too narrow in the process of detecting deception in persons being interrogated for crime acts. Faryniarz and Lockwood (1992) conducted an experiment to compare the effectiveness of CAI in teaching problem solving in the area of Environmental Science, with special attention given to lake pollution analysis, wastewater quality management, and population dynamics.

In their study of CAI effectiveness, Shute, Glaser, and Raghavan (1989) used an Intelligent CAI called Smithtown that focused on "students' effectiveness in collecting, organizing, and understanding data, concepts, and relationships in a new domain" (p. 281). Shute and Glaser (1990) replicated the study of Smithtown with different subjects. They "hypothesized that computer instruction on applying effective interrogative skills

(e.g., changing one variable at a time while holding all else constant) would ultimately lead to the acquisition of the specific subject matter. They described Smithtown as "an intelligent tutoring system designed to enhance an individual's scientific inquiry skills…" (p. 51).

Study Features and Categories

All the 21 studies were further examined to identify study features and categories that would enable comparisons to be made on the differences in CAI effectiveness. Some studies yielded more than one effect size each (e.g., Livergood, 1994; Yuill, 1991). For example, Livergood (1994) conducted his study in two phases. In the first phase, multimedia computer-assisted instruction was used while in the second phase, intelligent computer-assisted instruction was used. These two effect sizes could be placed into different categories. Therefore, effect sizes were used as the basis for the determination of study features and categories. Each effect size was given an identification number for easy reference. It was also determined that there should be at least two categories within each study feature and a sufficient number of effect sizes within each category for comparisons to be made. The categories also needed to be clearly differentiated such that effect sizes could be objectively distributed into the categories.

A subgroup of eight studies, yielding nine effect sizes, was very similar in the use of Intelligent Computer Assisted Instruction (ICAI). Two of the ICAI systems were repeatedly evaluated with different subjects in different studies. These evaluations provided valuable information on the consistency of the systems' effectiveness. There was another similarity among these studies. The ICAI systems were described in detail, reporting that huge efforts were spent to prepare these systems for use in instruction. It

was frequently reported in these studies that cognitive task analysis was applied to elicit mental models from experts in a particular area. Output of this cognitive task analysis was used in the development of the ICAI systems. For remainder of the studies, types of CAI were mostly a combination of simulation, tutorial, drill and practice, and multimedia. The CAI was only predominantly of one type but embodied the elements of other types. Unlike studies that used ICAI, the CAI studies did not detail what type of CAI was used. Reading the studies revealed differences between these studies and the studies described earlier that used ICAI systems. These differences were noted as a factor that could possibly have affected the effectiveness of computerized instruction. Therefore, CAI studies constituted one type of CAI while the ICAI studies constituted another type. To differentiate between the two, studies that used ICAI were grouped under Intelligent CAI while the rest were identified as CAI. However, the terms were used only when referring to the relationship between the type of computer-assisted instruction and effectiveness. Throughout the rest of the dissertation, the term CAI refers to both types of computer-assisted instruction.

Further examination of the studies revealed six other study features and their corresponding categories. Therefore, an initial set of seven study features and the corresponding categories was obtained that was comprised of (a) CAI type -- ICAI and CAI, (b) nature of treatment -- replacement and supplement, (c) type of subject assignment -- random, intact groups, and other assignments, (d) type of instructor assignment -- random and non-random, (e) treatment duration -- less than 4 weeks and more than 4 weeks, (f) educational level -- secondary/postsecondary, university, and adult military training, (g) setting - civilian and military.

Three studies were given to a second person to determine the interrater agreement in placing study effect sizes into the various categories. Agreement was high on all study features except instructor assignment and study duration. Instructor assignment was not commonly reported in the studies. Therefore, it was not included as a feature in this meta-analysis. It was also discovered that study duration could not be used as a study feature because of the various frequencies of treatment applied. The various time arrangements reported in the studies made it difficult to group studies according to categories of study duration. To avoid subjectivity, study duration was not examined in this meta-analysis. Therefore a total of five study features were identified with each having either two or three categories. The study features and categories are shown in Table 2.

Calculation of Effect Sizes

Effect sizes were calculated from (a) posttest effect size only, (b) the difference between posttest effect size and pretest effect size, (c) t-statistic, and (d) F-statistic from ANCOVA tables. Effect sizes, study features, and the corresponding categories for all studies are shown in Table 3. To illustrate in greater detail the range and magnitude of effect sizes according to the various study features, effect sizes were sorted by CAI type, nature of treatment, type of subject assignment, educational level, and setting and are shown in Tables 4, 5, 6, 7, and 8 respectively. The range and magnitude of effect sizes are also depicted by schematic plots showing the lowest, lower quartile, median, upper quartile, and highest values of effect sizes by study features. The schematic plots of effect sizes by CAI type, nature of treatment, type of subject assignment, educational level, and setting are shown in Figures 1, 2, 3, 4, and 5 respectively. The mean effect sizes and their

standard deviations for the different categories of the study features are presented in Table 9 together with the number of effect sizes and number of subjects.

Table 2

Study Features and Categories

Study Features	Categories
CAI type	CAI ICAI
Nature of CAI treatment	Replacement Supplement
Subject assignment	Random Intact groups Other
Educational level	Secondary / Postsecondary University Adult military training
Setting	Civilian Military

Table 3

Effect Size, Study Features and Categories of Studies

Study	Effect Size Code	Effect Size	Study Feature				
			CAI Type	Nature of Treatment	Subject Assignment	Educational Level	Setting
Fouad & Burleson	1A	0.16	CAI	Replacement	Other	U	C
Fouad & Burleson	1B	1.06	CAI	Supplement	Other	U	C
Parchman et al.	2A	0.02	CAI	Replacement	Intact Groups	AMT	M
Parchman et al.	2B	-0.09	CAI	Replacement	Intact Groups	AMT	M
Gokhale	3A	1.04	CAI	Replacement	Intact Groups	U	C
Gokhale	3B	0.41	CAI	Replacement	Intact Groups	U	C
Shute & Gawlick-Grendel	4	0.08	CAI	Replacement	Random	S / P	C
Gott	5	0.86	ICAI	NR	NR	AMT	M
Johnson	6	0.56	CAI	Replacement	Other	AMT	M
Janniro	7	0.86	CAI	Replacement	Random	AMT	M
Livergood	8A	0.11	CAI	Replacement	Random	U	C
Livergood	8B	0.49	ICAI	Replacement	Random	U	C
Faryniarz & Lockwood	9	0.46	CAI	Replacement	Intact Groups	S / P	C
Johnson et al.	10	1.12	ICAI	Supplement	Intact Groups	U	C
Shlechter et al.	11	0.12	CAI	Supplement	Other	AMT	M
Spotts	12	0.3	CAI	Replacement	Random	B	C
Yuill	13A	0.07	CAI	Supplement	Random	U	C
Yuill	13B	-0.12	CAI	Supplement	Random	U	C
Shute & Glaser	14A	-0.2	ICAI	Replacement	NR	U	C
Shute & Glaser	14B	1.13	ICAI	Supplement	NR	U	C
Kennison	15	0.27	NR	Supplement	Other	AMT	M
Shute et al.	16A	-0.1	ICAI	Replacement	NR	U	C
Shute et al.	16B	0.2	ICAI	Replacement	NR	U	C
Buergermeister	17	-0.11	CAI	Replacement	Intact Groups	U	C
Hwang	18	-0.13	CAI	Replacement	Other	S / P	C
Ogle et al.	19	0.04	CAI	Replacement	Random	S / P	C
Gott	20	1.02	ICAI	Replacement	NR	AMT	M
Malek & Luszczak	21	0.31	ICAI	Supplement	Other	AMT	M

Note: AMT is Adult Military Training, B is Business, C is Civilian, U is University, M is Military, NR is Not Reported, and S / P is Secondary / Postsecondary.

Table 4

Effect Size Sorted by CAI Type

Study	Effect Size Code	Effect Size
ICAI		
Shute & Glaser	14B	1.13
Johnson et al.	10	1.12
Gott	20	1.02
Gott	5	0.86
Livergood	8B	0.49
Malek & Luszczak	21	0.31
Shute et al.	16B	0.2
Shute et al.	16A	-0.1
Shute & Glaser	14A	-0.2
CAI		
Fouad & Burleson	1B	1.06
Gokhale	3A	1.04
Janniro	7	0.86
Johnson	6	0.56
Faryniarz & Lockw	9	0.46
Gokhale	3B	0.41
Spotts	12	0.3
Fouad & Burleson	1A	0.16
Shlechter et al.	11	0.12
Livergood	8A	0.11
Shute & Gawlick-C	4	0.08
Yuill	13A	0.07
Ogle et al.	19	0.04
Parchman et al.	2A	0.02
Parchman et al.	2B	-0.09
Buergermeister	17	-0.11
Yuill	13B	-0.12
Hwang	18	-0.13
Not Reported		
Kennison	15	0.27

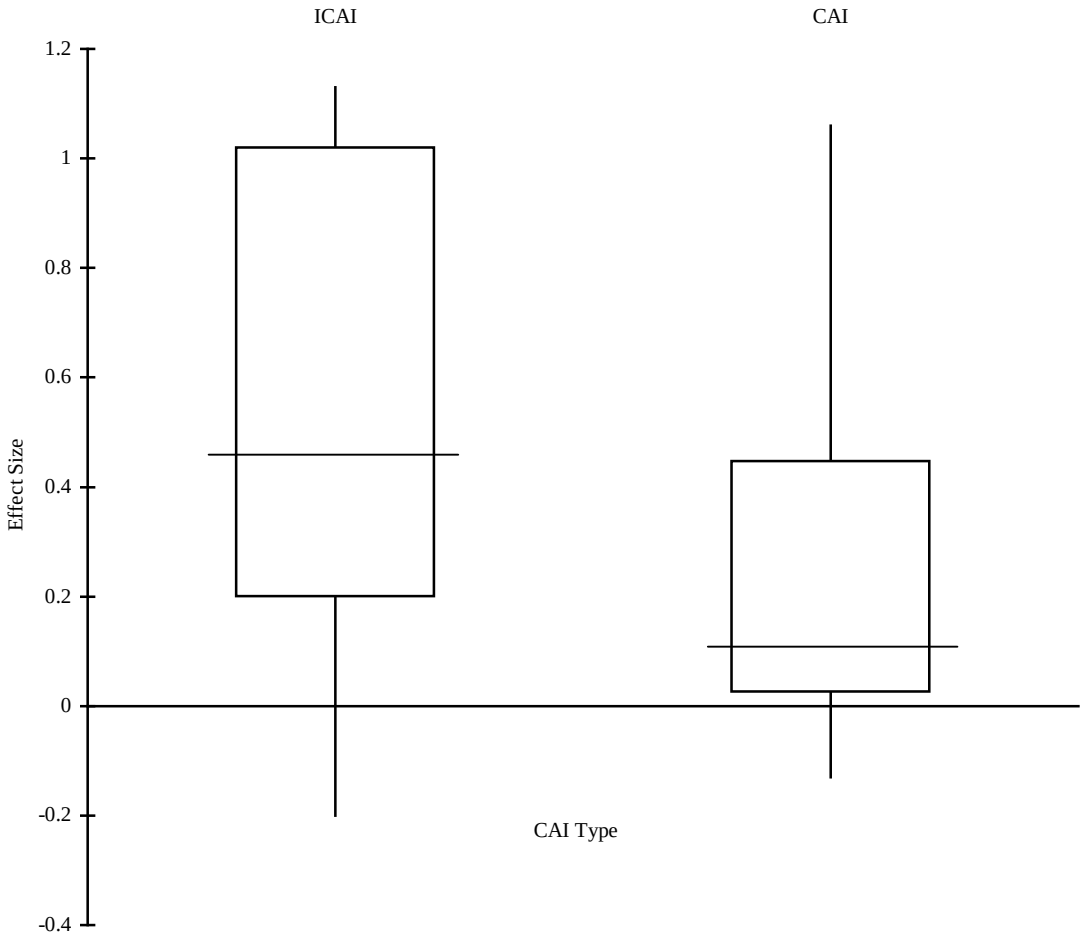

Figure 1: Schematic Plot of Effect Size by CAI Type

Table 5

Effect Size Sorted by Nature of Treatment

Study	Effect Size Code	Effect Size
Supplemental CAI		
Shute & Glaser	14B	1.13
Johnson et al.	10	1.12
Fouad & Burleson	1B	1.06
Malek & Luszczak	21	0.31
Kennison	15	0.27
Shlechter et al.	11	0.12
Yuill	13A	0.07
Yuill	13B	-0.12
Replacement CAI		
Gokhale	3A	1.04
Gott	20	1.02
Janniro	7	0.86
Johnson	6	0.56
Livergood	8B	0.49
Faryniarz & Lockwood	9	0.46
Gokhale	3B	0.41
Spotts	12	0.3
Shute et al.	16B	0.2
Fouad & Burleson	1A	0.16
Livergood	8A	0.11
Shute & Gawlick-Grende	4	0.08
Ogle et al.	19	0.04
Parchman et al.	2A	0.02
Parchman et al.	2B	-0.09
Shute et al.	16A	-0.1
Buergermeister	17	-0.11
Hwang	18	-0.13
Shute & Glaser	14A	-0.2
Not Reported		
Gott	5	0.86

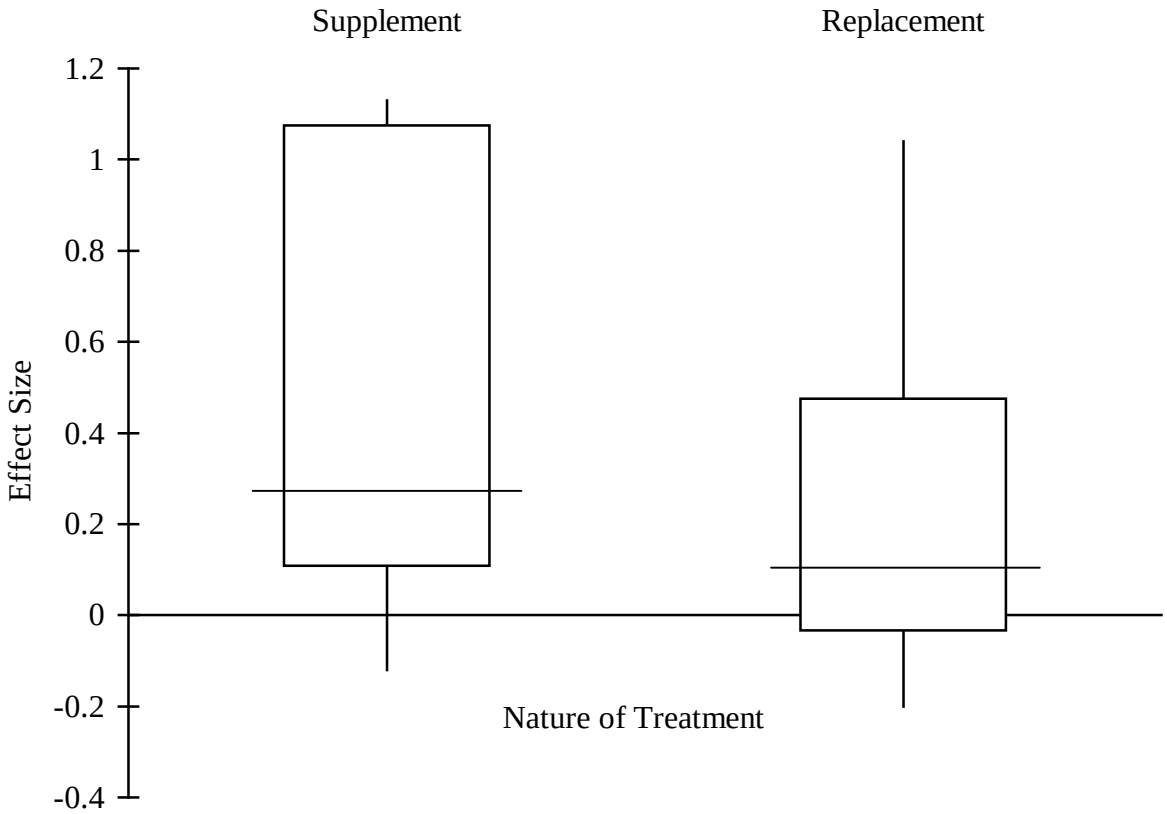

Figure 2: Schematic Plot of Effect Size by Nature of Treatment

Table 6

Effect Size Sorted by Type of Subject Assignment

Study	Effect Size Code	Effect Size
Random		
Janniro	7	0.86
Livergood	8B	0.49
Spotts	12	0.3
Livergood	8A	0.11
Shute & Gawlick-Grendel	4	0.08
Yuill	13A	0.07
Ogle et al.	19	0.04
Yuill	13B	-0.12
Intact Groups		
Johnson et al.	10	1.12
Gokhale	3A	1.04
Faryniarz & Lockwood	9	0.46
Gokhale	3B	0.41
Parchman et al.	2A	0.02
Parchman et al.	2B	-0.09
Buergermeister	17	-0.11
Other		
Fouad & Burleson	1B	1.06
Johnson	6	0.56
Malek & Luszczak	21	0.31
Kennison	15	0.27
Fouad & Burleson	1A	0.16
Shlechter et al.	11	0.12
Hwang	18	-0.13
Not Reported		
Shute & Glaser	14B	1.13
Gott	20	1.02
Gott	5	0.86
Shute et al.	16B	0.2
Shute et al.	16A	-0.1
Shute & Glaser	14A	-0.2

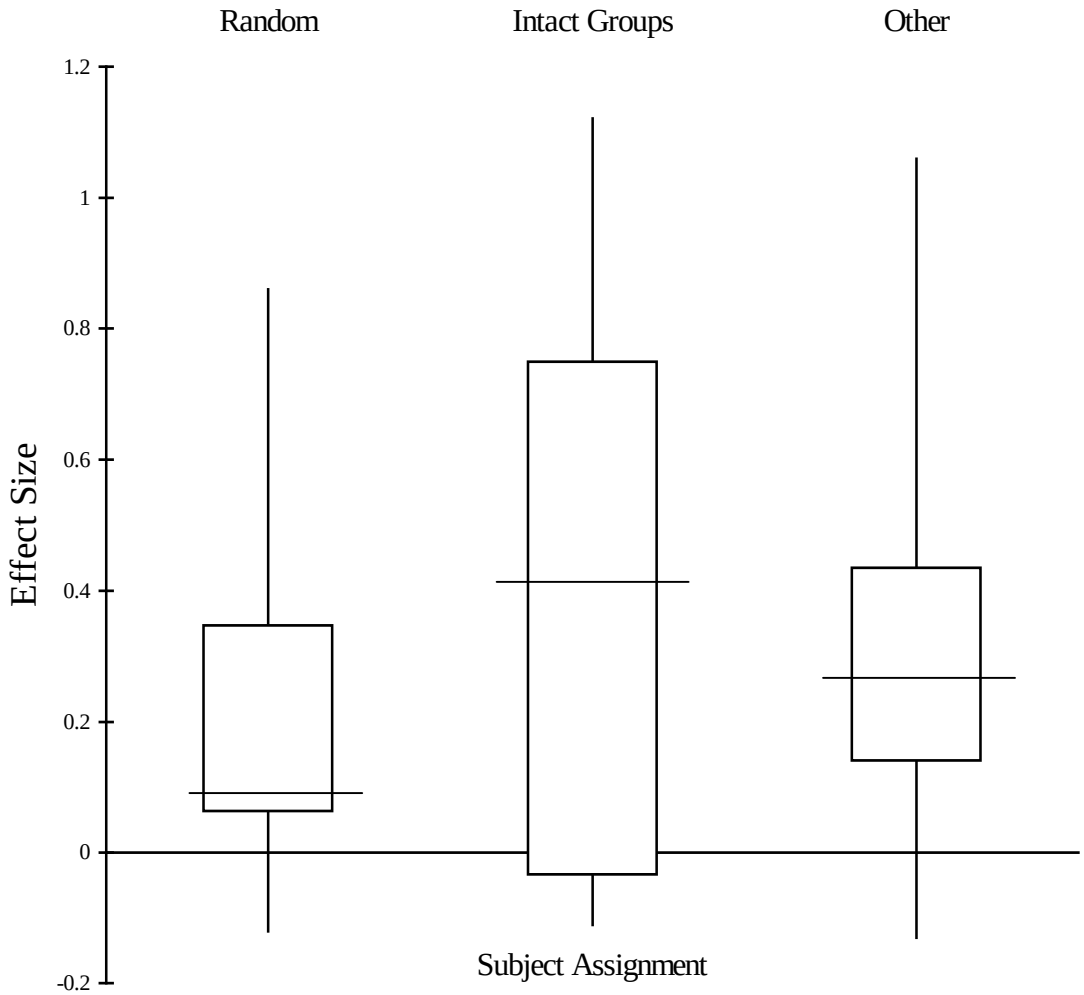

Figure 3: Schematic Plot of Effect Size by Subject Assignment

Table 7

Effect Size Sorted by Educational Level

Study	Effect Size Code	Effect Size
Secondary / Postsecondary		
Faryniarz & Lockwood	9	0.46
Shute & Gawlick-Grendel	4	0.08
Ogle et al.	19	0.04
Hwang	18	-0.13
University		
Shute & Glaser	14B	1.13
Johnson et al.	10	1.12
Fouad & Burleson	1B	1.06
Gokhale	3A	1.04
Livergood	8B	0.49
Gokhale	3B	0.41
Spotts	12	0.3
Shute et al.	16B	0.2
Fouad & Burleson	1A	0.16
Livergood	8A	0.11
Yuill	13A	0.07
Shute et al.	16A	-0.1
Buergermeister	17	-0.11
Yuill	13B	-0.12
Shute & Glaser	14A	-0.2
Adult Military Training		
Gott	20	1.02
Gott	5	0.86
Janniro	7	0.86
Johnson	6	0.56
Malek & Luszczak	21	0.31
Kennison	15	0.27
Shlechter et al.	11	0.12
Parchman et al.	2A	0.02
Parchman et al.	2B	-0.09

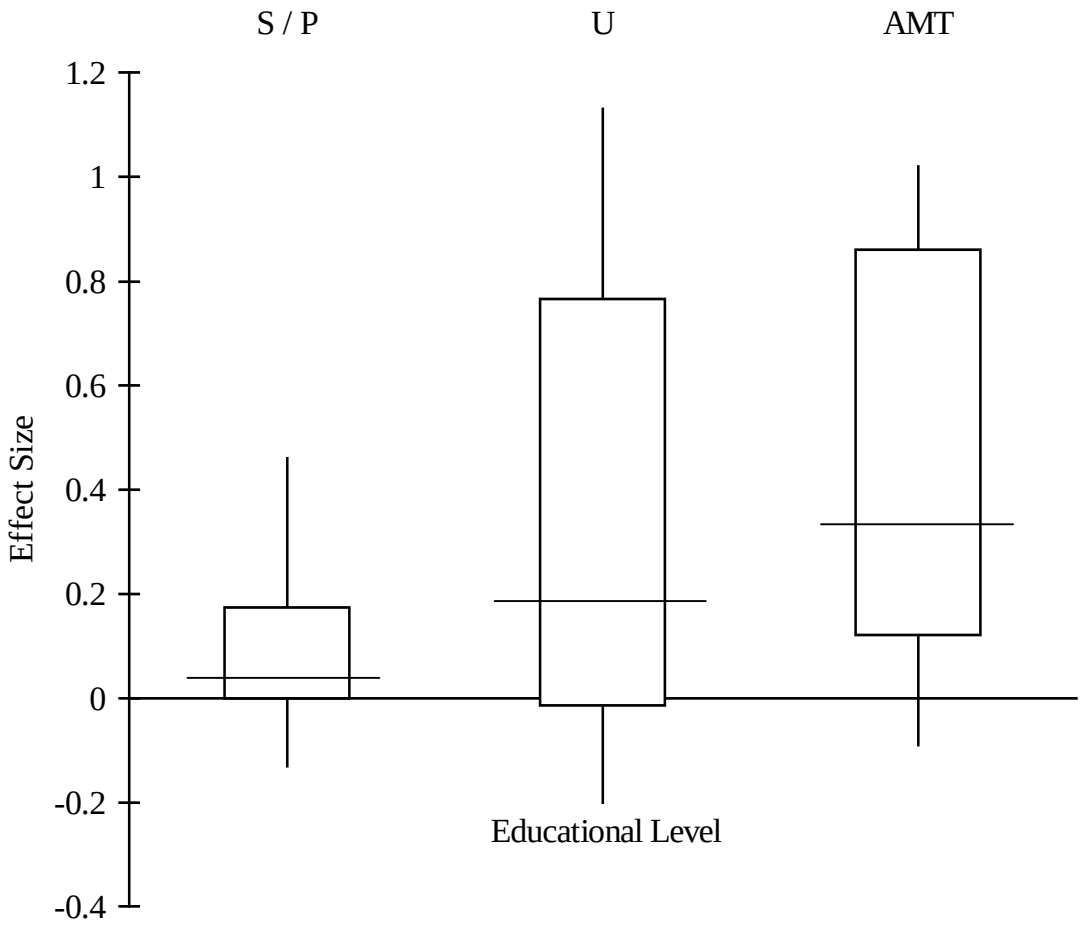

Figure 4: Schematic Plot of Effect Size by Educational Level

Note. S / P is Secondary/Postsecondary, U is University, and AMT is Adult Military Training.

Table 8

Effect Size Sorted by Setting

Study	Effect Size Code	Effect Size
Civilian		
Shute & Glaser	14B	1.13
Johnson et al.	10	1.12
Fouad & Burleson	1B	1.06
Gokhale	3A	1.04
Livergood	8B	0.49
Faryniarz & Lockwood	9	0.46
Gokhale	3B	0.41
Spotts	12	0.3
Shute et al.	16B	0.2
Fouad & Burleson	1A	0.16
Livergood	8A	0.11
Shute & Gawlick-Grendel	4	0.08
Yuill	13A	0.07
Ogle et al.	19	0.04
Shute et al.	16A	-0.1
Buergermeister	17	-0.11
Yuill	13B	-0.12
Hwang	18	-0.13
Shute & Glaser	14A	-0.2
Military		
Gott	20	1.02
Gott	5	0.86
Janniro	7	0.86
Johnson	6	0.56
Malek & Luszczak	21	0.31
Kennison	15	0.27
Shlechter et al.	11	0.12
Parchman et al.	2A	0.02
Parchman et al.	2B	-0.09

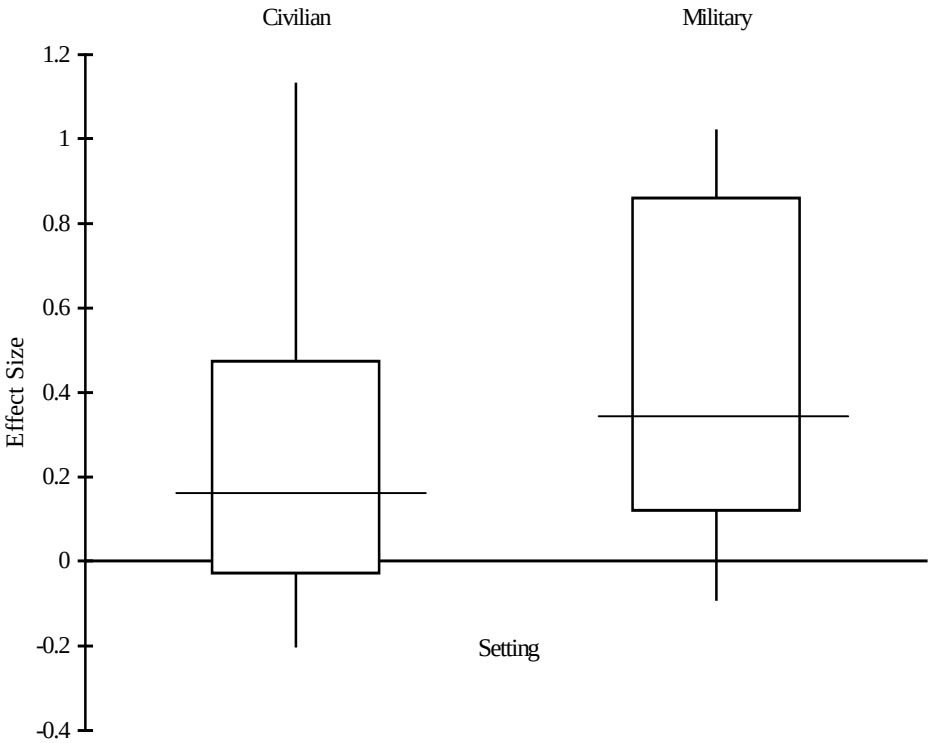

Figure 5: Schematic Plot of Effect Size by Setting

Table 9
Study Features and Effect Size

	Effect Size			
Study Features	N	Subjects	M	SD
CAI type[a]				
CAI	18	2513	0.27	0.39
ICAI (ITS)	9	385	0.65	0.54
Nature of CAI treatment[b]				
Replacement	19	1248	0.32	0.44
Supplement	8	1667	0.49	0.52
Subject assignment[c]				
Random	8	738	0.23	0.31
Intact groups	7	322	0.40	0.51
Matched & randomized / other	7	1743	0.34	0.38
Educational level[d]				
Secondary / postsecondary	4	465	0.11	0.25
University	14	726	0.45	0.55
Adult military training	9	1758	0.44	0.41
Setting				
Military	9	1758	0.44	0.41
Civilian	19	1211	0.37	0.50

[a] One effect size was omitted because the corresponding study did not report CAI type.

[b] One effect size was omitted because the corresponding study did not report the nature of treatment.

[c] Six effect sizes were omitted because the corresponding studies did not report how subjects were assigned.

[d] One effect size was omitted because the study was conducted with employees of a business entity.

Analysis and Interpretation of Findings

The preceding section presented facts and information. The following sections present analysis and interpretation of the results according to the research questions for the study. The statistical analyses were performed using Analysis ToolPak which is a data analysis tool in Microsoft Excel 97.

Research Question 1:

What is the overall effectiveness of CAI on achievement as compared to traditional instruction?

The overall effectiveness of the studies was determined by the overall effect size, which was obtained by adding all the effect sizes and dividing by the total number of effect sizes. The overall effect size was determined as 0.35. According to Pedhazur and Schmelkin (1991), cited in Brown (1996), effect sizes can be classified as small for values less than 0.2, medium for values of 0.5, and large for values of 0.8 and greater. Therefore, the overall effect size in this meta-analysis can be considered as "between small and medium."

The overall effect size of 0.35 also implies the mean achievement score for CAI students was 0.35 standard deviation greater than the mean achievement score for students taught in the traditional manner. A graphic representation of this value is shown in Figure 6. The figure was prepared based on a standardized score of 0.35 covering an area corresponding to the 64th percentile under the standard normal curve. If the same performance measure was applied for both groups, the "average" students taught in the traditional manner who scored at the 50% level would have scored at the 64% level if taught through CAI. The word "average" refers to the students whose score is the mean

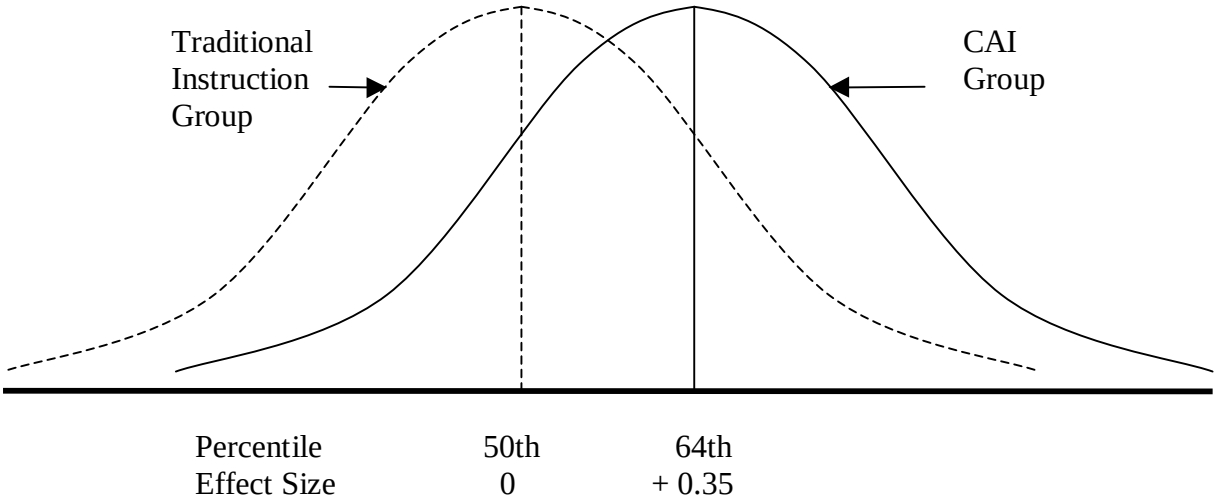

Figure 6: Overall Effect Size

for the group. Although the overall effectiveness of teaching method showed an advantage for CAI over traditional instruction, the relative superiority of CAI was only modest.

The above interpretation should be understood concurrent with the fact that eight effect sizes, representing about 30% of the total number of effect sizes, were supplemental. In these eight effect sizes, both groups received the same traditional instruction but the experimental group was given additional computerized instruction. As anticipated, it can be seen from Table 9 that the mean effect size from replacement CAI studies only ($\underline{M}$ = 0.32) was smaller than the mean effect size from supplemental CAI only ($\underline{M}$ = 0.49). If replacement CAI studies only were used to calculate the overall effect size for this meta-analysis, the obtained value would be 0.32 (Table 9), which is only slightly smaller than the overall effect size of 0.35 that included replacement and supplemental CAI. Therefore, the inclusion of supplemental effect sizes did not produce a misrepresentation of the overall effectiveness of CAI.

Research Question 2:

What are the study features and corresponding categories on which differences in CAI effectiveness can be identified?

An examination of the studies revealed the features and corresponding categories (Table 2). The study features were as follows: (a) CAI type -- categorized into ICAI and CAI, (b) nature of treatment -- replacement and supplement, (c) subject assignment -- random, intact groups, and others, (d) educational level -- secondary / postsecondary, university, and adult military, and (e) setting -- military and civilian.

Study features with two categories were examined using t-tests while study features with three categories were examined using one-way ANOVA. These statistical analyses were performed to determine whether differences in CAI effectiveness could be found between categories within a particular study feature.

The third research question was: What differences in CAI effectiveness exist between categories in each of the identified study features?

Since the study features and categories had been identified, this research question was transformed into the following five questions according to the study features.

Research Question 3:

Is there a difference in effectiveness between the following types of CAI: (a) CAI, and (b) intelligent CAI?

A t-test was performed to determine whether effect sizes from studies classified as ICAI were different from studies classified as CAI. A significant difference was found between Intelligent CAI ($M = 0.65$, $SD = 0.54$) and CAI ($M = 0.27$, $SD = 0.39$), $t(25) = 2.1$, $p < .05$. The test revealed that intelligent CAI was significantly more effective than CAI.

Research Question 4:

Is there a difference in effectiveness between the following nature of CAI treatment: (a) CAI that replaced traditional instruction, and (b) CAI that supplemented traditional instruction?

Studies were also categorized according to the implementation nature of the computer-assisted instruction. If the computer-assisted instruction was used to provide instruction to the experimental group while the control group received traditional

instruction, it was categorized as “Replacement” CAI. If both groups received traditional instruction but the experimental group was given additional computerized instruction, it was categorized as “Supplement” CAI. A t-test was conducted to investigate the relationship between nature of treatment and effect size. The test showed no significant difference between CAI applied as a replacement to traditional instruction ($\underline{M}$ = 0.32, $\underline{SD}$ = 0.44) and CAI applied as a supplement to traditional instruction ($\underline{M}$ = 0.49, $\underline{SD}$ = 0.52), $\underline{t}(25) = 0.89$, $\underline{p} > .1$. Therefore, CAI effectiveness was not related to the nature of CAI treatment.

Information in Table 5 and Figure 2 can be used to describe the above finding. Although some effect sizes for supplemental CAI were greater than the effect sizes for replacement CAI (Table 5), the effect sizes were distributed in the range between 0.1 and 1.1 whereas the effect sizes for replacement CAI were more concentrated in the range between 0 and 0.5 (Figure 2). Seven of the effect sizes for supplemental CAI were positive, indicating that CAI was more effective than traditional instruction in about 88% of the supplemental CAI (Table 5). In contrast, fourteen of the nineteen effect sizes for replacement CAI are positive, indicating that replacement CAI was more effective than traditional instruction in about 74% of the replacement CAI (Table 5). The difference in these percentages was not high.

Research Question 5:

Is there a difference in effectiveness between CAI studies that grouped subjects according to (a) random assignment, (b) intact groups, and (c) other types of subject assignments that were not random or intact groups?

Results for the three types of subject assignment were: (a) random assignment (M = 0.23, SD = 0.31), (b) intact classes (M = 0.40, SD = 0.51), and (c) matched and randomized, and other arrangements (M = 0.34, SD = 0.38). An analysis of variance (see Table 10) was performed to determine the relationship between the type of subject assignment and effect size. It was found that CAI effectiveness is not significantly different between studies that used the three types of subject assignment, F (2, 18) = 0.37, p > .1.

Table 10

Analysis of Variance for Subject Assignment

Source of Variation	df	F
Between Groups	2	0.37
Within Groups	18	
Total	20	

Research Question 6:

Is there a difference in effectiveness between CAI that was implemented at the following educational levels: (a) secondary / postsecondary, (b) university, and (c) adult military?

Results for the three educational levels were: (a) secondary / postsecondary (M = 0.11, SD = 0.25), (b) university (M = 0.45, SD = 0.55), and (c) adult military training (M = 0.44, SD = 0.41). An analysis of variance (see Table 11) was performed to determine the relationship between educational level and effect size. It was found that CAI effectiveness is not significantly different between the three educational levels, F(2, 23) = 0.88, p > .1.

Table 11

Analysis of Variance for Educational level

Source of Variation	df	F
Between Groups	2	0.88
Within Groups	23	
Total	25	

Research Question 7:

Is there a difference in effectiveness between CAI that was implemented in the following settings: (a) civilian, and (b) military?

Studies from the military and civilian settings were analyzed using a t-test to see if there was a significant difference between effect sizes from studies conducted in the military ($M = 0.44$, $SD = 0.41$), and effect sizes from studies conducted in the civilian sector (($M = 0.37$, $SD = 0.50$). It was discovered that the difference was not significant, $t(26) = 0.35$, $p > .1$. Therefore, CAI effectiveness was not significantly different between studies conducted in the military and civilian settings.

Summary

The overall effect size of CAI in technical education and training was found to be 0.35. This magnitude was considered as "between small and medium." There was a significant difference between effect sizes of studies that used Intelligent CAI and studies that used CAI. The effectiveness of CAI was found not significantly different between categories in the following study features: (a) nature of treatment -- replacement or supplement, (b) subject assignment -- random, intact groups, or other, (c) educational level -- secondary / postsecondary, university, or military, and (d) setting -- military or civilian.