RETENTION OF MATHEMATICS AND READING COMPREHENSION SKILLS AMONG NAVY FUNCTIONAL SKILLS PROGRAM GRADUATES

by

Pedro A. Cartagena

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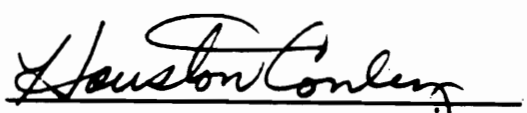

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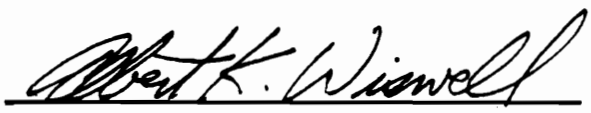

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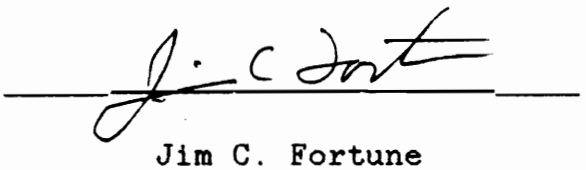

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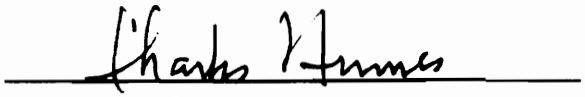

Charles Humes

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Committee Chairman: Houston Conley
A. K. Wiswell, Co-Chairman
Educational Administration

(ABSTRACT)

This study was conducted to investigate mathematics and reading comprehension skill retention of Navy's 1987 Functional Skills Program graduates over three to twelve month period immediately following training. Two separate studies were conducted. One studied math retention for a course using Computer-Assisted Instruction (CAI). The other study investigated a reading comprehension course using Personalized System Instruction (PSI). Subjects (N = 97) were divided into four groups based on the length of time elapsed since graduation (3 to 12 months). The sample was the same for both courses, which ran concurrently for eight weeks. Subjects were primarily low academic achievers. The majority were male caucasians (median age 23) from low socio-economic background.

A quasi-experimental design using pre-, post, and delayed posttest with a two-way within-subjects ANOVA (Achievement x Time) with repeated measures on the time factor was used to analyze the data. Fisher's LSD tests were utilized in post hoc contrast of the group's pre-, post and delayed posttest mean scores.

Supplementary data collection and analysis conducted using an orally administered questionnaire suggested that many students were intimidated by computer-based instruction. They also reported that Navy related materials used in the PSI course were too easy to read and did not challenge the reader enough.

A statistically significant increase was detected between the pretest and posttest of the math groups under the CAI treatment, indicating that learning took place from pre- to posttest. However, a significant decline was found in math skills over time (posttest to delayed), possibly due to the lack of opportunities for practice of those skills after the training. Likewise, the reading comprehension course using PSI modality produced evidence of a significant increase between pretest posttest scores. This treatment showed no evidence of significant changes over time in reading skills from posttest to delayed test. Practice effects of informal reading activities and the self-motivating effect of skill development were offered as explanatory mechanisms for sustaining these skills.

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The preparation of this dissertation relied upon the contribution of many people. I would like to thank those people who have helped to make this work possible.

I am indebted to Dr. Houston Conley and Dr. Albert Wiswell for serving as Co-Chairpersons of my doctoral committee. Special thanks to Dr. Robert R. Richards and Dr. Albert K. Wiswell. This dissertation became a reality with their participation. Their advice and guidance throughout my graduate program helped me to complete this work. I am specially appreciative of Dr. Jimmie Fortune for his moral support during critical periods. His timely contributions to the methodology of the work proved invaluable. Several colleagues shared their ideas with me. Detailed comments from Dr. Betty Koball and Dr. Albert K. Wiswell were particularly helpful and strengthen the thesis.

Acknowledgment must go to those who provided their support during this project. Among these were personnel from the Naval Education and Training Support Center (Atlantic), Central Texas College, and the Navy Campus Functional Skills Program. Moreover, an expression of gratitude goes to the sailors who participated as respondents in this research. For the clerical support so vital to the preparation of this project, I thank my

wife Maria del Carmen. To her, I owe special debt. Her administrative and editing talents continue to be of inestimable value.

Dedication

I dedicate this dissertation to my wife Maria del Carmen without whose help, assistance, and faithful unyielding support this work would not have been possible.

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Chapter 1

Introduction

As the United States deals with the challenge of arresting functional illiteracy, improving the quality of public education is an obvious first step. Many suggest that functional illiteracy in America can be restraint, however not eliminated. The illiterate, like the poor, will unceasingly be present in our society because of the influx of immigrants, the rising literacy standards, and the continuing competition of television with the printed word (Harmon, 1986).

A greater federal effort is required to define adult illiteracy and collect data to determine the actual size and scope of the problem (Irwin, 1987). The complexity of the issue suggests that such governmental concern must extend beyond program funding or public awareness campaigns. An effective effort must include federal backing of successful community based literacy programs, adult functional skills programs, and research (Micklos, 1985; Harmon, 1986).

A distinction has been made between functional literacy and functional competence. Functional literacy is defined as the reading and writing skills necessary to understand and use printed material as normally encountered at work, leisure, and citizenship (Clearing House on Adult Education,

1988). Functional competence includes, in addition, the problem solving and mathematical skills needed to complete everyday societal tasks. The discrepancy between a population's literacy and the skills required to perform most jobs is referred to as the job literacy gap (Stedman & Kaestle, 1987). Leaders in industry, business, government, the armed forces, and education are concerned about the increasing number of individuals without sufficient reading and writing skills.

Workplace literacy concerns constitute a relatively new social phenomenon. Mikulecky & Ehlinger (1986) reported that workers often accomplish job tasks by talking with and observing others (Stedman & Kaestle, 1987; Sticht, 1975). Recent research suggests that schools may develop sets of literacy skills unlike those typically needed on the job (Diehl & Mikulecky, 1980; Kirsch & Guthrie, 1984; Sticht, 1975). The consequences are that many workers are able to perform their jobs without the reading skills required to read manuals. In the end, they rely on peer on-the-job-training.

Community colleges, public libraries, churches, community-based education and development organizations, corporations, and labor unions are trying to fight functional illiteracy (Whitman, 1989). Retention of basic

skills is a problem. Merely completing high school does not mean that a person will perform at that level. According to the National Assessment of Education Progress (NAEP) many graduates read just above the basic level (4th-grade). In order to minimize the impact of this problem, eighty-four percent of 1,400 colleges surveyed deemed necessary to have remedial reading, writing, and math programs (Harmon, 1986).

Illiteracy in the Military

According to Harmon (1986) and Irwin (1987) the American military has a long experience combating adult functional illiteracy. Since World War II, the United States Army has used tests to identify trainees who need additional educational training to comprehend written military instructions (Kirsh and Guthrie, 1977-78; Stedman, 1987). Lately, the Army has improved the performance levels of its recruits with efforts such as Project FLIT (Functional Literacy Training). This is a six-week course using operating manuals and other written materials which soldiers actually use in the line of duty (Harmon, 1986).

The Defense Department's Armed Services Vocational Aptitude Battery (ASVAB) administered to a representative sample of recruits in 1980 revealed that the median reading grade level for those recruits was 9.6. Of this group, an

average of 18 percent performed below the 7th-grade level (Kirsch, 1985; Sum, Harrington, & Goeddicke, 1986). The United States Navy reported that 30 percent of its recruits were a danger to themselves and to costly equipment because they could not understand written instructions (Weir, 1986).

These findings suggest that functional literacy problems pervade the pool of potential recruits if not the whole of American society. Functionally illiterate adults are considered socially and economically incapacitated because they cannot perform specific tasks, skills, or objectives thought necessary to become a productive member of society (Carnegie Forum on Education and the Economy, 1986; Harmon, 1986; Weir, 1986; Irwin, 1987; Stedman & Kaestle, 1987). Incompetence in the nation's work force implies losses through low productivity, accidents, employee errors, and the cost of extra training (Irwin, 1987). Many major corporations and the federal government train new and old workers in basic reading, writing, and arithmetic (Weir, 1986; Harmon, 1986).

The Navy is also concerned about the effects of functional skills training or lack of training on their personnel (Appendix A). In order to address this issue, the Navy Campus Field Office Norfolk, Virginia, makes use of two types of functional skills classes. One makes use

of Personalized System Instruction (PSI) or Programmed Instruction and is made-up of contractual designed material which is based on general knowledge aptitudes. The second type relies on the use of Computer-assisted Instruction (CAI) and is composed of government furnished job-oriented materials. Personalized System Instruction (PSI) consisted of:

- Unit mastery requirements
- Individualized pacing
- Programmed Instructional materials
- Proctors (module approach)
- General knowledge (contractor designed)
- Aptitude based objective (General Knowledge)
- Government furnished Navy job related materials

The Computer-Assisted Instructional (CAI) program was also programmed instruction, with some modifications, such as:

- Extensive use of computers
- Drill directed instruction.
- Individual performance assessed by computer
- Reliance on self-directed learning.

In developmental mathematics and reading programs, Programmed Systems Instruction (PSI) strategies are widely accepted, in such places as mathematical labs, learning

centers, and conventional classrooms (Thompson, 1980). Hasset and Thompson (1978) reported superior achievement in these academic areas using PSI strategies. Computer-assisted Instruction (CAI) is a relatively new development and there is limited research in the area of functional skills. Therefore, this study was conducted to investigate mathematics and reading comprehension skill retention of the Navy's 1987 Functional Skills Program graduates.

Statement of the Problem

The problem to be investigated by this study was the assessment of mathematics and reading comprehension skill retention of the Navy's Functional Skills Program graduates over a minimum period of three months and a maximum period of 12 months.

Research Questions

Following a literary analysis of the topic, several questions were formulated to serve as guide for this documented investigation:

1. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction?

2. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

3. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction?

4. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

5. Will Computer-Assisted Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

6. Will Personalized Systems Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

Hypothesis of the Study

Based on a review of the literature, the following two hypotheses are presented in the null:

Hypothesis 1: There will be no statistically significant difference between posttest and delayed posttest scores with Computer-Assisted Instruction (CAI).

Hypothesis 2: There will be no statistically significant difference between posttest and delayed posttest scores with Personalized System Instruction (PSI).

Significance of the Study

The coordinators of the Navy Functional Skills Program at the Field Office, Norfolk, Virginia, have identified the need to determine the retention levels of both the PSI and CAI educational strategies on program participants (Appendix A). To-date (1986-1990) no previous studies had

been conducted to determine the reading and mathematics skills level achieved by the Navy's Functional Skills Program participant over time (12 or more months). The Navy Campus Office Norfolk was interested in documenting the impact of the functional skills program on participants' skill retention. This information will assist the Navy to make informed decisions about future program developments.

Definitions of Terms

The following definitions have the purpose of facilitating the reader's understanding of the concepts presented in this investigation. Consistent with the thrust of this study, the following terms are defined:

1. Functionally illiterate - A description of persons who cannot function effectively within society because they do not possess sufficient basic skills in reading, writing, or arithmetic needed to become productive members of their society. This includes those who have not had the privilege of a formal education as well as those who have graduated from a public or private school system, but who do not master these basic skills.

2. Adult - An individual who has attained 16 years of age or who is beyond the age of compulsory school attendance under the law (Public Law 100-297, 1988).

3. Adult Education - Instruction or services below the college level for adults who do not have:

   A. the basic skills to enable them to function effectively in society, or

   B. a certificate of graduation from school providing secondary education (and who have not achieved an equivalent level of education).

4. Adult Basic Education - Adult education for adults whose inability to speak, read, or write the English language constitutes a substantial impairment of their ability to get or retain employment commensurate with their real ability.

   The program is designed to:

   A. eliminate educational inabilities of adults and raise the level of education of such individuals with a view of making them less likely to become dependent on others.

   B. provide these adults with sufficient basic education to enable them improve their ability and to benefit from occupational training.

   C. increase their opportunities for more productive and profitable employment.

   D. enable participants to fully enjoy the benefits and responsibilities of citizenship.

   F. assist participants in meeting their adult responsibilities.

   G. provide an avenue for adults to continue their education to at least a secondary school level.

5. Educational Disadvantaged Adult - Any adult who:

   A. demonstrates basic skills equivalent or below that of student at the fifth grade level, or

   B. has been placed in the lowest or beginning level of an adult education program when the program does not use grade-level equivalencies as a measure of students' basic skills (Public Law 100-297, 1988).

Limitations of the Study

This study is limited to Navy enlisted persons who participated in the computer-assisted and personalized

systems instruction courses offered by the Navy Functional Skills Program. Findings are not generalizable to any other environments.

Organization of the Study

This study is organized into five chapters. Chapter one is an introduction and is subdivided into: statement of the problem, research questions, significance of the study, definitions, limitations, hypothesis, and organization of the study. Chapter two is a review of the literature, while Chapter three is the methodology. Chapter four contains the findings of the study and chapter five is a summary of the conclusions drawn from those findings.

Chapter 2

Review of the Literature

Introduction

There has been considerable discussion about adult illiteracy in the United States (Clearing House on Adult Education, 1988; Irwin, 1987; Kozol, 1985; Whitman, 1989). Media reports suggest widespread illiteracy among adults who may not be able to read, write, speak, or otherwise communicate competently enough to meet the demands of modern society (Irwin, 1987; Wier, 1986; Micklos, 1985). The U. S. Department of Education estimate of the adult illiteracy rate is 13 percent or 17 to 21 million persons (Clearing House on Adult Education, 1988; Irwin, 1987). Other estimates of illiteracy, functional incompetence, and marginal competency range from 0.5 percent to 50 percent of the adult population (Stedman & Kaestle, 1987; Harmon; 1986). Depending upon whose figures one uses, the conclusion on the illiteracy problem may fluctuate from one in which illiteracy is extremely common to a notion that it is a problem of epidemic proportions. Regardless, the inability to function effectively in society is a major problem (Kaestle, 1985). The purpose of this chapter is to review research literature on adult functional literacy and individualized instructional approaches that address it.

Definition of Issue

According to Paul Irwin (1987), the definitions of literacy and the appropriate societal responses are core of the issue. Two definitions of literacy are recognized: a conventional, involving simple reading and writing skills and a functional, where a more complex set of skills and proficiencies are used as the standard (p. 2).

Webster's New World Dictionary (1988) defines literate as "ability to read and write." Today, literacy is defined in relation to the demands of society in which an individual must function. The definition of functional literacy depends on the specific tasks, skills, or objectives thought necessary for the comprehension of a literate person (The Clearinghouse on Adult Education, 1988). This definition becomes more complex as the technological and informational needs of the society increase (Irwin, 1987; Stedman and Kaestle, 1986).

A National Assessment on Educational Progress (NAEP) study entitled, Literacy: Profiles of American Young Adults, posed the following definition of literacy:

> "Using printed and written information to function in society, to achieve one's goals and to develop one's knowledge and potential" (Clearing House on Adult Education, 1988, p. 1)

School Literacy versus Functional Literacy

Another area of debate is the relationship between the skills taught and measured in schools (literacy) and the skills required and practiced outside the school (functional literacy). A distinction is made between functional literacy or job literacy, functional competency, and unemployment. Functional literacy refers to the reading and writing skills necessary to understand and use printed material normally encountered in work, leisure, and citizenship. Functional competency is similar, but also includes problem solving and the mathematical skills needed to complete everyday societal tasks . Unemployment is caused primarily by economic conditions and a general lack of jobs. Job literacy refers to an individual's inability to secure employment because he or she lacks the basic functional skills required to hold any job (Hymowitz, 1981).

Crude Literacy

Guthrie & Kirsch (1984) and Mikulecky & Ehlinger (1986), argued that inside the realm of school co-exists two levels of literacy. The first level known as crude literacy is the ability of a student to learn to read and understand simple words. At a higher level, the student is expected to demonstrate competency in vocabulary, complex

inferential, and interpretive skills. On the other hand, functional literacy outside the school is less structured, involves a greater variety of materials, and requires the completion of practical tasks (Mikulecky, 1982; Guthrie, 1986).

Origin of Term "Functional Literacy"

Folger & Nam (1967) reported that the term functional literacy was first used by the Civilian Conservation Corps (1930). The corps defined functional literacy as three or more years of schooling and being able to read the essential printed material of daily life. Guy Buswell (1937) was the first pioneer in functional literacy testing. He tested 897 Chicago-area adults residents in such daily tasks as finding prices in mail-order catalogs or phone numbers in telephone directories. This study concluded that performance varied according to education and reading habits. No further testing effort was done until 1970, when several studies were conducted (Gadway & Wilson, 1976; Harris, 1970; Murphy, 1973; Stedman and Kaestle, 1986).

The term "functional illiteracy" was also used during the 1940s and 1950s to describe persons who were incapable of understanding written instructions necessary to accomplish specific tasks or functions. In particular, the U.S. Army used tests to distinguish trainees who needed

additional educational training before they could comprehend written military instructions (Irwin, 1987).

Measuring Functional Literacy

Four methods have been utilized to measure functional literacy outside the school. These are: school attainment, administering functional skills tests, comparing reading levels to printed material, and investigating job literacy.

Educational Attainment

Educational attainment has been used as proxy for functional literacy. At the onset of World War II, the Armed Forces used the term functionally literate to refer to recruits who had a fourth-grade educational level (Ginzberg & Bray, 1953). Following suit, the Census Bureau (1947) considered those with fewer than five years of schooling to be functional illiterates (U.S. Bureau of Census, 1948). By 1952, the Bureau had raised the functionally literate level to sixth grade ((U.S. Bureau of Census, 1953). The U.S. Department of Education (1960) used an eighth grade level as their standard for functional literacy (Fisher, 1978; Harman, 1970). In the 1970s functional literacy was perceived in terms of high school completion (Carroll & Chall, 1975; Hunter & Harman, 1979). The assumption made by the increased criteria was that people who reach a certain grade acquired a enough reading

skills to function in society. One major flaw to this assumption is that educational attainment as a measure of functional literacy is equating schooling with learning and some people perform below grade level (U. S. Census, 1960-1980). Stedman & Kaestle (1987) considered that the proper assessment of functional literacy requires testing the population on functional literacy tasks.

Functional Literacy Testing

Several functional literacy tests were conducted to assess the functional literacy problem: Survival Literacy Study, National Reading Difficulty Index, Mini-Assessment of Functional Literacy, Adult Functional Reading Study, Adult Performance Level Project (APL), and the English Language Proficiency Survey (U.S. Department of Education, 1986).

Survival Literacy Study

One of the first functional literacy testing studies was conducted by Harris and Associates (1970-1971) for the National Reading Council. The result was the Survival Literacy Study, which tested the ability of 16 year olds to read, understand, and fill out application forms. It showed that on an average 3 percent of the population

could not fill out these applications properly and were considered illiterate (Harris, 1970; Kirsch & Guthrie, 1978).

National Reading Difficulty Index

The National Reading Difficulty Index (1971) sampled people 16 years of age and older by filling out forms such as applications passports, driver's license, and credit cards. This study also conducted by the Harris Association tested the population's ability to read three types of materials: telephone dialing and rate information, classified housing ads, and classified employment ads. The researchers concluded that these participants suffered from serious deficiencies in functional reading abilities (Harris, 1971).

Mini-Assessment of Functional Literacy

A third study demonstrated 12.6 percent of the nation's 17-year-old students could not read word passages, reference materials, and graphic material. These include charts, maps, coupons, pictures, and forms. The investigation called was named the Mini-Assessment of Functional Literacy (1971-75). The study was conducted by National Assessment of Educational Progress (NAEP) for the U.S. Department of Education's National Right-To-Read. The researchers chose 75 percent of answers correct as

the threshold for functional literacy. They found that 12.6 percent of the nation's 17-year-old students did not reach the 75th percentile. The study concluded that these students were functionally illiterate (Gadway & Wilson, 1976). The President's National Commission on Excellence in Education (1983) used this figure of 13 percent in their Nation at Risk report (Stedman & Kaestle, 1987).

Adult Functional Reading Study

The Adult Functional Reading Study organized by the Education Testing Service found that one out of four adults tested could not handle maintenance items which dealt with sick leave, occupational items, discrimination information, and employment application. This represented 18 percent of the population (Murphy, 1973; 1975).

Adult Performance Level Project (APL)

A study of functional competence was the fifth study. The Adult Performance Level Project (APL, 1977), sponsored by the U.S. Office of Education, was conducted by the University of Texas. The study assessed writing, computation, and problem solving as well as reading. Tests were designed to measure knowledge of information and as well as skills. The test deliberately distinguished between those who were considered successful in the society (high school graduates) and those persons who were

unsuccessful (less than eight years of school, unskilled, unemployed, and living in poverty). Researchers identified three competency levels of performance: level one were functionally incompetent adults, level two were marginally competent, and level three were the fully competent. They reported that 19.7 percent of the adult population ages 18 to 65 were at Adult Performance Level 1. One-fifth (23 million) of the adult population of the U.S. were found to be functionally incompetent and 33.9 percent of the adult population were in APL 2 or marginally incompetent. Considering both groups, a total of 53.6 percent (72 million) of the population experienced difficulty functioning (Irwin, 1987; Kirsch & Guthrie, 1978).

The federally funded study of 7,500 adults based on a questionnaire of 300 questions found that 20 percent of the adult population were functionally incompetent, 34 percent were marginally competent or "just getting by," and 46 percent were fully competent or proficient. The 1975 study made use of the 1970 census data for persons 18 to 64 years old (115 million adults). Based on these findings, the study estimated 23 million persons to be functionally incompetent, 39 million marginally competent, and 53 million proficient (Irwin, 1987).

Paul M. Irwin (1987) applied the APL study criterion to the 1985 population (191 million) of person 14 years or over. The report concludes that, using this criteria, 38 million would be functionally incompetent, 65 million persons marginal, and 88 million would be competent. Although this study provided some insights on adult population literacy rates, the use of this information today suffers from two major drawbacks: (1) a national survey has not been repeated, (2) a majority of adult classified by the APL as less than competent can read, write, and perform simple calculations (Stedman & Kaestle, 1987).

English Language Proficiency Survey

The English Language Proficiency Survey (1982) conducted by the U.S. Bureau of Census at the behest of the U.S. Department of Education was designed to judge how well 20 year old or older adults could read official notices and application for public assistance written in English. The illiteracy rate for English speaking persons was 9 percent and 48 percent for non-English home language (Werner, 1986).

Equating Reading Levels to Ability to Read Printed Materials

Researchers (Stedman & Kaestle, 1987; Vogt, 1973) have measured functional literacy by comparing the population's

reading level to that of their ability to read common everyday life material (Fisher, 1978; Kirsch, 1985; Sum, Harrington, & Goedicke, 1986). They concluded that literacy as taught and measured at school can be correlated with reading achievement (Guthrie & Kirsch, 1984; Mikulecky & Ehlinger, 1986). Accordingly, Corder reviewed the performance of students from several standardized tests to determine the reading levels of students in various grades. Stedman & Kaestle (1987) reported that Corder extrapolated the figures to the general population on the basis of school attainment and reported that thirteen percent of 12th-grade students read below an 8th-grade level and that fourteen percent of those in 8th-grade read below a 5th-grade level.

Functional Literacy Research and Military Service

During World War I the United States Army pioneered job literacy research (Yoakum & Yerkes, 1920). The researchers tested worker's skills and created a occupational ability patterns or skills level required to perform a particular job (Dodge, 1935; Dvorak, 1935). The Department of Defense continued such research to the present day.

The Department of Defense (1980) developed the Armed Services Vocational Aptitude Battery (ASVAB) test in order to identify qualified recruits and make assignments to

occupations and training (U.S. Department of Defense, 1984). This test administered to a representative sample of 18 to 23 year-olds showed that the median reading level was 9.6, eighteen percent of this sample read below the 7th-grade level (Kirsch, 1985; Harrington & Goedicke, 1986).

The military experience is illustrative of the workplace literacy gap. Responding to training deficiencies during the Vietnam Conflict, the Defense Department embarked on a functional literacy research program. The military agencies were concerned that many enlistees were not sufficiently literate to handle military occupations. They wanted to determine how best to close the gap between personnel skills and assigned tasks. Sticht (1975) and his colleagues made a study of four Army occupation and concluded that 12 percent of the new recruits read below the 6th-grade level and that the Army's average reading level was 9th-grade (pp. 170-171). They reported:

> "...the reading demands of Army jobs, even the less complex ones, far exceed the reading ability of many personnel..." (Stedman & Kaestle, 1987, p. 38).

Investigating the Job Literacy Gap

Job literacy gap or the growing discrepancy between

the population literacy level and the skills required to perform a job is an area of social concern. The history of such an assessment has demonstrated the difficulty in determining which level of reading is associated with satisfactory job performance. A variety of research has shown that individuals with limited reading skills can hold jobs. Half of the military personnel tested by Sticht read below the 8th-grade level, yet performed their skilled jobs satisfactory (Sticht, 1975). Vineberg and Taylor found that one third of the Army personnel with the lowest basic skills scores were the above-average job performers (Sticht, 1982). Contrary to the job literacy gap, low reading-achievement scores (5th-grade through 8th-grade) were not a barrier to job competence. Nevertheless, educational researchers (Stedman & Kaestle, 1987) report that severe reading deficiencies interfere with the ability to hold many occupations, but that above a certain threshold, reading level as measured by standardized tests have little to do with job performance.

A Nation at Risk, a report by the Commission on Excellence in Education (1983), espoused that America is becoming a high-technology society which requires far more advanced skills than those currently found in the society. Kirsch and Guthrie (1984) reported that jobs requiring no

literacy were rapidly disappearing. The implication is that the changing workplace will require more literate people.

Bowles & Gintis (1976) and Bowles (1979) presented the premise that white-collar work has been proletarianized. The trend under this condition is been that jobs are "dumbed down." These jobs require only limited skills when compared to trade and professional jobs that have definable skill requirements.

Workers Learn by Observation

Mikulecky & Ehlinger (1986) reported that workers often accomplish job tasks by talking with and observing others The consequence is that many workers are able to perform their jobs without reading the skills to read the manuals. In the end they rely on peer on-the-job-training.

Work in America Report

The Federal Commission that produced the report Work in America (O'Toole, 1973) found that workers were better educated than their jobs. They recommended the expansion of worker control over the job descriptions or responsibilities. Stedman & Kaestle (1987) argue that if the Work in America report were to be correct any increase in the skills demanded by jobs would be welcomed because this would mean that the skills required were finally

beginning to catch up with the skills of an overeducated workforce. However, the military as well as major corporations continue to spend vast sums of money on remedial training. This suggests that many entry-level workers continue to lack basic job skills (U.S. Congress, 1986; Kirsch & Guthrie, 1984; Sticht, 1982).

National Assessment of functional Literacy

Several researchers have attempted to study the job literacy gap at the national level. Lerner (1981) conducted a national assessment of the job literacy gap to prove that unskilled workers outnumbered unskilled jobs. She based her claim on the Mini-Assessment of Functional Literacy, a study which reported that 12.6 percent of 17-year-olds to be functional illiterates. However, the comparison made by this study was misleading. Most participants possessed functional skills since they scored above the 60th percentile. Second, the study focused on general skills, such as reading maps or using a dictionary, so marginal performance was not necessarily due lack of job reading skills. In an another attempt to assess the job literacy gap Berg and Gorelick (1971) used the Department of Labor's Dictionary of Occupational Titles. This document is an index of General Educational Development (GED) which measures the verbal, reasoning, and

mathematical skills necessary to perform a job. They claim that by comparing the distribution of this index to the population's educational level researchers can estimate the job literacy gap. Stedman & Kaestle report that these GED's have severe limitations because they are based on job descriptions and not on actual reading demands. Other researchers also agree there is no fixed relationship between the years of schooling and the GED scores, since scores are assigned subjectively (Fine, 1968; Spenner, 1980; Sticht & McFann, 1975).

Societal Consequences

Media reports link functional illiteracy with adverse consequences to the individual and society. Some of these consequences can be lack of employment, income, job status, and lack of self-esteem (Irwin, 1987; Harmon, 1986; Carnegie Forum on Education and the Economy, 1986). High rates of functional illiteracy are reported among those on public assistance and in criminal institutions (Weir, 1986; Harmon, 1986). Illiteracy also impinges on national security. A study by the National Advisory Council on Adult Education (1986) reported 40 percent of the Armed Services enlistees read below the 9th-grade level. Thirty percent of Navy recruits pose a danger to themselves and costly equipment because they cannot understand written

instructions (Weir, 1986). The nation's universities find it necessary to provide remedial reading and writing courses for students. An estimated 50 percent of the prisoners in jail are functionally illiterate (Lane, 1980; Harmon, 1986; Weir, 1986; Irwin, 1987). Annually ten billion dollars is spent by private corporations in remedial programs such as reading, writing, and math for employees (Irwin, 1987; Whitman, 1989). Jonathan Kozol (1985), author of Illiterate America, suggests that functional illiteracy reduces the nation's Gross National Product (GNP) by more than $100 billion per year by reducing productivity (Irwin, 1987). The author also exposes the fact that it will take five billion per year to curtail the problem (Micklos, 1985). The American Library Association claims that functionally illiterate adults cost $224 billion annually in welfare payments, crime, job incompetence, lost taxes, and remedial education (Weir, 1986; Irwin, 1987). An additional $237 billion per year in unrealized earnings is forfeited by these marginal performers, according to the Literacy Volunteers of America (Irwin, 1987).

Functional illiteracy tends to be passed from generation to generation (Irwin, 1987). Illiterate parents cannot read to their children, assist them to with homework

or introduce them to the world of books. The National Assessment of Educational Progress (NAEP) reports that students whose parents failed to complete high school are nearly twice as likely as their peers to be functionally illiterate (Harmon, 1986).

Managing the Functional Literacy Problem

The variety of definitions, statistical data results, and programs makes the illiteracy problem hard to manage. Several issues are at play: a single program can not address the various types of persons involved; the success or failure of the programs depends on several public agencies, such as schools, social services, and other government agencies; participation in the programs is a decision made by the individual and appears to be a matter of personal choice and the individuals with the most need may not realize the advantage of such training. In the final analysis, the options for action against adult illiteracy are diverse. Community literacy action programs can provide some assistance.

Office of Educational Research and Improvement (OERI)

Under the U. S. Department of Education, the Educational Research and Improvement completed a series of projects on adult literacy. One such project is the Commission on Reading. This particular project had the

objective of producing a synthesis of reading research and state-of-the-art techniques in the teaching of reading. In 1985, the commission's first report entitled, "Becoming a Nation of Readers," made several recommendations:

1. Parents should increase their involvement in reading to preschool and in-school children.
2. Teachers should make more effective use of simple phonics instruction (limited to no later than the second grade).
3. Students should spend more time in independent reading, writing, and techniques of reading comprehension.
4. Schools should be more supportive of reading and library programs.
5. Teacher training programs should be improved.

Findings and Solutions

Whether the job literacy gap is large or small is not as crucial as recognizing that serious basic literacy problems do exist. Studies have linked workers' reading strategies with job performance (Diehl & Mikulecky, 1980). Mikulecky & Winchester (1983) found that although general reading ability did not relate to job performance, reading to properly assess a job did. Other researchers (Mikulecky & Ehlinger, 1986), concluded that workers with strong

reading skills perform better for several reasons: first, they know how to focus their attention on reading materials and job tasks; second, they have developed systems for organizing information; third, are able to explain how their activities related to their overall purposes; and are able to monitor their own performance . These findings suggest that job literacy may not be solved by concentrating on basic academic skills or by simply raising the students' reading grade on standardized tests (Stedman & Kaestle, 1987). Sticht (1982) concluded from a study of military training that literacy training must involve job-specific literacy tasks to be successful. Basic skills programs raise a person's academic grade levels when they are coupled directly with instruction in job literacy training (Kaestle, 1985; Stedman & Kaestle, 1986).

Computer-Assisted Instruction and Functional Skills

Various educational strategies have been developed in an effort to alleviate the problem of lack of functional skills in the nation's population. Students have received training in reading, language, and mathematics. However, they usually need programs which are individualized, that provide extensive practice opportunities, and are motivating.

New Developments in Individualized Instruction

Two schoolwide approaches used to teach students to work individually are Programmed Instruction (PI) and Computer-Based Instruction (CBI). Programmed Instruction is also known as Personalized System Instruction (PSI) can be used to enhance individualized instruction. Likewise, positive results have been reported in student reading and math courses with manageable cost, when computer-assisted instruction is used.

Programmed Instruction

Programmed instruction is a remedial program where the student is presented with content (relatively brief presentations of about a sentence or a paragraph of instructional material). He is then asked to respond respectively (correctly answer a question or solve a problem) and immediately thereafter receives information as to the correctness of his or her response. Programmed instruction courses are designed in frames. The frames are arranged in such a sequence that leads the learner from the entering level (ignorance) to a level of full knowledge and understanding (skilled). This allows most students (90 percent) to be able to respond correctly to most frames. In this way, the student is likely to experience positive reinforcement as he or she progresses through the program

of instruction. The positive feedback accompanying a correct response insures a high probability of the student making a correct response in the future and strengthens the learner's motivation or desire to learn (Gage & Berliner, 1984).

Programmed instruction is of major value in several specific educational scenarios: when learning a particular skill (i. e. how to compute a correlation coefficient) or for remedial and enrichment purposes, but the approach is not recommended for taking over a major part of the instruction in a given subject. However, programmed instruction has increased attention to improving classroom management and school organization. It has led to the development of improved instructional materials and Personalized System Instruction (PSI). PSI is a form of programmed instruction.

Personalized System Instruction (PSI)

The Keller Plan, also known as Personalized System Instruction (PSI), has yielded superior results over traditional course formats. Kulik, Kulik, & Cohen (1979) reported the results of a comparison study of 75 courses taught both conventionally and by PSI. Their study reported that Personalized System Instruction (PSI) produces superior student achievement, less variation in

achievement, and higher ratings on college courses, but does not affect course withdrawal or student study time in these courses. The average final examination score of conventional classes was 50th percentile, that of the PSI was about 70th percentile. They concluded that PSI students were also superior on retention tests, given several weeks after the end of the course. These students scored higher on both multiple-choice and open-ended final examination questions. Performance was superior in both low-and-high aptitude students. PSI yielded superior scores in subject matters such as natural sciences, social sciences, mathematics, and engineering.

The Keller Plan of Personalized System Instruction

Behavioral psychologist F.S. Keller (1968) designed an individualized instruction for colleges and universities. The plan breaks up the course into fifteen to thirty units. The student studies each unit and then takes a test on it. If the student passes the test, she or he goes on to the next unit. According to Gage & Berliner (1984) the plan is:

1. Self-paced. Students complete the course as fast or slowly as they want. The program does not depend on how they perform in relation to their peers.

2. Mastery oriented. Student must master instruction before progressing on to new material.

3. Tutored. Advance students provide help, encouragement and support to the novice.

4. Provided with study materials.

5. Supplemented with other traditional instructional techniques (Lectures, movies, television, etc.).

Shortcomings of Personalized System Instruction

The one feature most liked by students enrolled in Personalized System Instruction is the ability to pace himself and work on his time. However, there are also some draw backs to this method:

1. Procrastination on the part of the student (Reiser & Sullivan, 1977; Calhoun, 1973).

2. Lack of interaction between students (Gasper, 1980).

3. Subject to standardization of the mind (Jaynes, 1975).

Contributions of Personalized System Instruction

Gage and Berliner (1984) reported that in the classroom Personalized System Instruction has made the following contributions as:

1. High success rate.

2. Improves instructional materials.

3. Renews efforts to individualize instruction.

4. Enrolls student in learning process.

5. Produces immediate educational feedback.

6. Provided with study guides.

7. Supplemented with traditional instructional techniques.

Computer-Assisted Instruction (CAI)

Although programmed instruction has produced many good results, the educational approach has virtually disappeared. Yet, with the development of computer technology, programmed instruction has evolved into Computer-Assisted Instruction. Gage and Berliner (1984) report that Computer-Assisted Instruction makes possible programmed instruction and with certain advantages:

1. Information concerning the individual student's responses can be stored, retrieved, processed statistically and reviewed by the teacher.
2. The information concerning groups can be analyzed statistically.
3. One computer can store information from many students via modem lines connected to terminals.
4. Information concerning the latency of the student's response can be collected.
5. Materials can be presented to the students in nonverbal form (i.e. pictures, diagrams, etc.).

The foremost advantages of computer-assisted instruction strategies is that the teacher is saved from the boring task of reviewing and scoring the student's work (specifically in drill problems in reading or arithmetic, where the teacher has to decide instantly whether the student needs more such practice or can skip

to the next kind of problem) and the problems of adapting to the student's changing performance (Robertson, Ladewig, Strickland, & Boschung, 1987).

Cost Effectiveness of Computer-assisted Instruction

Computer-assisted instruction can be mass produced and the use of CAI facilities could drive the cost per student down into a manageable range. A pilot CAI program in the city of Los Angeles between 1976 to 1980, one ten minute session of computer-assisted instruction daily throughout the school year was estimated to cost about $130 (Ragota, 1982). Levin & Woo (1979) reported:

> "it was found that up to three sessions of drill and practice of ten-minute duration could be provided for each disadvantage child at the present level of Title I expenditure...it appears that the instructional strategy is cost feasible within the present provisions for compensatory education (p. 32)."

Suppes (1966) defined three levels of computer-assisted instruction: dialogue, tutoring, and drill and practice. Computer-assisted instruction was found to be inadequate in spoken language response or to written language essays. This is to say that the average computer cannot engage in dialogue with the student. CAI with much effort can be made capable of tutoring by branching out from the root or program in ways that takes into account the student's response history (drill & practice). Computers can be

programmed to respond much like a human being and even use humor to encourage the student to continue on, even after an incorrect response. Patricia A. Weir (1986) reports that programs for higher order learning are still being developed and tested in some schools (i.e. Navy Campus Office Norfolk, Virginia is one example). Most of these computers are used to drill students and to test the materials learned. Among the computer-based approaches to teaching higher order thinking skills are the Logo programming language, software tutorials in logic, and computer simulations involving planning and analysis. The computer-based drills and skills testing may be just a variation on a workbook or other supplemental material. Current research (Gage & Berliner, 1984; Robertson, Ladewig, Strickland, & Boschung, 1987) shows that computers are a more efficient learning tool because they provide immediate feed-back and tracking of the student's performance.

Weir (1986) claims that computers can improve learning by 10 to 40 percent and improve long-term retention when combine with teacher assistance. Even more, a curriculum based on computer learning can contribute to a better attitude toward school by instilling intangible skills,

such as: pride, perseverance, and positive attitude. However, computer-assisted learning has some drawbacks.

Limitations of Computer-assisted Instruction

In the area of higher order learning the computer-based learning, there are three limitations:

1. The transfer and application of problem-solving skills acquired on the computer to other lessons.
2. Unrealistic perceptions on how much time the student actually gets on a computer.
3. How to integrate the computer into traditional lessons.

The evidence to-date in the areas of simulation and tutorials points toward the fact that students taught using computer-based instruction are learning the subjects rather than assimilating a problem-solving process. Students who were not challenged by traditional methods may be attracted to the computer, but economic realities in school may make the time-on-line be limited in order to serve everyone eligible.

Computer Anxiety and Education

Computer anxiety is defined as fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer (Howard, 1987). Computer anxiety has been found to be a legitimate phenomenon with complex origins, that occurs with widely

varying degrees among different individuals (Weinberg & English, 1983). It has been theorized that computer anxiety in college students could impose a significant barrier to developing positive attitudes toward computers, learning about technology, and acquiring the operational skills needed for their use (Raub, 1981; Howard, Lahey & Murphy, 1986).

Several investigators have noted that involvement in computer-assisted instruction (CAI) may result in the improvement of students self-esteem (Robertson, Ladewig, Strickland & Boschung, 1987). Mevarech and Rich (1985) found that students who participated in a mathematics computer-assisted program rated themselves significantly higher on self-concept in arithmetic achievement than students exposed to the same material in a traditional instructional setting. Several possible reasons for these gain in self-esteem are that:

1. Mastery of subject matter content and development of computer literacy may be a potential sources of positive affective development (Brown, 1986; Dalton & Hannafin, 1984; Waldrop, 1984; Robertson, 1987).

2. External support appears to contribute to positive attitudes, especially in the form of peer group reinforcement (Robertson, 1987).

3. The computer is nonjudgmental, neutral, and consistent in its reinforcement and offers an optimal reward situation (Clement, 1981; Dalton and Hannafin, 1984; Waldrop, 1984; Robertson, 1987).

4. The privacy of the CAI learning situation provides the student freedom from embarrassment, disapproval, or diminished status often accompanying a mistake in the classroom (Brown, 1986; Clement, 1981; Dalton and Hannafin, 1984; Waldrop, 1984; Robertson, 1987).

5. The reduction in negative reinforcement allows the student to learn through trial and error at his or her own pace. Therefore, positive attitudes can be protected and enhanced.

Motivation and Computer-Assisted Instruction

Maverech (1988) conducted a study which investigated the differential roles of internal motivation profiles in predicting mathematics achievement of students exposed to computer-assisted instruction. She noted that children who preferred challenging tasks, liked to gain mastery, and were motivated by curiosity achieved significantly higher scores than their counterpart on the computer, but not on the paper-and-pencil examination. In contrast, those students who were independent with respect to their teacher's judgment and who had self-criteria for success and failure tended to perform better on paper-and-pencil test, but not at the computer. The findings support the conviction that the instructional effectiveness of CAI is related to the student's motivation.

There is further evidence that computer-based education can be taught in a way that would reduce computer anxiety.

This is founded on the fact that successful treatment for math anxiety cognitive behavior modification, have been developed (Fenneman, 1976), and that math anxiety and computer anxiety are similar phenomena.

Effectiveness of CAI and Mathematics

The results of numerous studies that examined the effectiveness of computer-based drill and practice (Burns & Bozeman, 1981; Hartley, 1977; Samson, 1985; and Kulik, Kulik, & Bangert-Drowns, 1985) were integrated using meta-analysis techniques. This integration of results, concluded that computer-based practice substantially raises achievement scores, primarily in mathematics and less frequently in language learning (Becker, 1984; Jamison, Suppes, & Wells, 1974; Ragosta, Holland, & Jamison, 1982; and Hativa, 1988). Saracho (1982) reported:

> "CAI has been shown to be effective in teaching subjects such as reading, language, arts, and mathematics to low achievers...Also, the students seem to have a positive attitudes toward this type of instruction (p. 204)."

Basic Skills and Computer-Assisted Instruction

Saracho (1982) conducted a study to investigate the effects of computer-assisted instruction on basic skills achievement and attitudes toward instruction of Spanish-speaking migrant children. The results of this study indicated that students who used the CAI program had

greater achievement gains than did students who participated in the regular classroom programs. However, students who were in the non-CAI program had more favorable attitudes toward CAI than did students in the CAI program.

Carver & Hoffman (1981) investigated the effects of repeated readings upon reading ability using a pre-, post, and delayed posttest strategy and computer-based instruction strategy. The researchers used the Gates-MacGinitie Reading Test and a Plato IV computer. Two separate studies were conducted with six high schools students in each study. Specific gains in fluency on the practice task were clearly evident and large gains on one general reading ability (grade 5 to 8). However, on the second measure, there were little evidence of gain. In short, they concluded that the effects of reading practice upon gain reading ability over time (pre-, post, and delayed) may be limited. They did not, however, consider that practice maintained skills that may otherwise have declined.

Summary

Functional illiteracy has adverse consequences to the individual and society. The societal consequences are manifested as unemployment, income, job status, lack of

self-esteem, and the necessity for remedial reading and writing courses for students. Even more, high rates of functional illiteracy are reported among those on public assistance and in criminal institutions.

On the side of the individual, the human tragedy has even deeper scars as illiteracy is passed on from generation to generation. Furthermore, functional illiteracy impinges the quality of the Armed Forces and our national security.

The Armed Forces used the term "functional illiterate" to identified a series of trainees who required additional educational training before they could comprehend written directives or be capable of understanding written instructions necessary to accomplish specific military tasks or functions. Studies (National Advisory Council on Adult Education, 1986) suggest that many (40 percent) of the Armed Services enlistees read below the 9th-grade level.

The first significant federal adult literacy program came from this military experience. The program became the the Manpower Development and Training Act of 1964. This act provided job training for the unemployed. However, many participants were found to be illiterate and

the program was amended to provide basic educational skills. Likewise, the Economic Opportunity Act of 1964 served grants to programs for persons requiring basic literacy skills. The Adult Education Act was designed as part of the Elementary and Secondary Education Amendment of 1966 (P. L. 89-750). To this end the Navy has established the Navy Campus Functional Skills Program.

The Navy Functional Skills Program is a cooperative effort between the chief of Naval Education and Training and American Preparatory Institute. This educational program offers Navy personnel the opportunity to improve functional skills in English, reading, mathematics. All of these courses offered help the individual review functional educational skills that apply to job-related and life coping tasks. However, the effort must begin with a clear definition of the problem.

Despite the consensus that some measure of functional illiteracy must be incorporated to the conventional definition, no agreement has been reached on a comprehensive definition of literacy. Hence, without a widely accepted measure of illiteracy, it is impossible to accurately document or refute media reports of widespread functional illiteracy. This chapter attempted to clarify

these issues for Navy Functional Skills Program administrators and provide a foundation for future program expansion and maintenance.

Chapter 3

Methods and Procedures of the Study

Introduction

The purpose of this chapter is to describe the methods and procedures in the study. The chapter is divided into seven sections: (1) overview of study, (2) research design used in the study, (3) description of how the subjects of the study were selected, (4) the instrumentation, (5) description of the procedures used in collecting the data, (6) how the data was collected, and (7) discussion of procedures used in the analysis of the data.

Overview

Treatment groups were taught in two separate but simultaneous 45-day units of instruction, one in mathematics, the second in reading comprehension. The math course (n = 97) made use of Computer-Assisted Instruction (CAI). The reading course (n = 97) utilized Personalized System Instruction (PSI). The instructors were functional Skills teachers, who were experienced in CAI and PSI methodology.

All students had similar loads, schedules, extracurricular activities, and living conditions. Course content and primary text were the same for all group

categories within each treatment. All students chosen for the study attended both courses.

Standardized lesson objectives and student workbooks were provided for all the students. Instructors were constrained to proceed through the curriculum uniformly on an established schedule. Testing procedures and test administration times were also standardized. Graded tests were returned to the student by the next class period as a form of feedback or progress report in the PSI treatment and immediately by the computer in the CAI treatment. A progress test was administered at the end of each week. Students were encouraged to seek extra self-instruction and to visit with instructors during office hours. Instructors' accessibility was high. The CAI treatment was on line for six months prior to the study. The PSI treatment had been established for over three years. Preparations for the study included a pilot run with over 20 functional skills students to standardize test procedures and questionnaires.

In order to facilitate the study, the students were divided into groups (levels of time) based on the length of time elapsed since graduation from the course. The intent was to compare the posttest performance gain scores to delayed posttest after a 3 month to 12 month time lapse.

The levels of time were: group one, students with 3 months (n = 37) since graduation; group two, students with 6 months (n = 17) since graduation; group three, students with 9 months (n = 19) since graduation; and group 4 students with 12 month (n = 24) since graduation. Alternate forms of the pretest were administered upon completion of the training as a posttest (April-November 1987). Delayed posttesting took place during the months of February, March, April, and May 1988 at the Naval Educational Support Center, Atlantic, Norfolk, Virginia. This design is shown in Table 1.

Table 1

Group Testing Design

Group	PRE	POST	DELAYED POSTTEST			
			Feb88 3 mo.	Mar88 6 mo.	Apr88 9 mo.	May88 12 mo.
1(n = 37)	Oct87	Nov87	X			
2(n = 17)	Aug87	Sep87		X		
3(n = 19)	Jun87	Jul87			X	
4(n = 24)	Apr87	May87				X

Computer-Assisted Instruction

The students taught by Computer-Assisted Instruction (n = 97) followed the specifications described by the computer programs and teacher handbook for implementing the software package. In this modality, the majority of the instructional time was spent working with the computer individually with little to no interaction between the student and the facilitator of the course.

The following flow plan displays in graphic form the how the mathematics study developed:

Computer-Assisted Instruction Model

CAT
Pretest - CAI Instruction - Posttest - Delayed Posttest
MATH

Personalized System Instruction (PSI)

A pretest, post and delayed posttest quasi-experimental design was used to study four reading comprehension groups. The modality of delivery for these groups was Personalized System Instruction (PSI).

The Personalized System Instruction students (n = 97) made use of individual drill and homework exercises as well as teacher lecture, presentations, and textbook assignments. Although teacher lecturing was utilized, all drill exercises and related studying in the PSI modality was

accomplished in class using pre-set modules. A daily and weekly tests served to evaluate the progress of the students.

The following flow plan depicts how the study developed in graphic form:

Personalized System Instruction Model

GMRT
Pretest - PSI Instruction - Posttest - Delayed Posttest
Reading

Research Design

This study made used of a quasi-experimental design to independently study two pedagogical strategies. The two modalities studied were Computer-Assisted Instruction (CAI) and Personalized System Instruction (PSI). The purpose of the study was to assess the long-term (3 to 12 months) mathematics and reading comprehension skill retention of the Navy's Functional Skills Program graduates.

The study had the intention of studying retention levels across different levels of time and addressed these following questions.

1. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction?

2. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-

Assisted Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

3. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction?

4. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

5. Will Computer-Assisted Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

6. Will Personalized Systems Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

Selection of Subjects

The study was conducted onboard the Naval Station, Norfolk, Virginia. The sample size of ninety seven (N = 97) subjects was the same for both the mathematics and reading comprehension instructional units. These were sailors stationed at the Naval Station, Norfolk, Virginia.

These subjects were mostly low income (under $7,000) male caucasians with a history of educational problems: low achievers attempting to meet the minimum requirements to obtain a High School Equivalency (GED) diploma, persons whose English Comprehension Level (ECL) scores were considered inadequate, or personnel preparing to re-take

the Armed Services Vocational Aptitude Battery (ASVAB). The median age was 23 years. Table 2 is descriptive demographic data of the sample.

Table 2

Descriptive Data of Sample

Variable: Income					
Group	N	Income	Number	Percentage	
	97	<7,000	66	68%	
	97	<10,000	14	15%	
	97	<13,000	9	9%	
	97	<16,000	4	4%	
	97	<20,000	3	3%	
	97	<24,000	1	1%	
Group	N	Mean	Std. Deviation	Min.	Max
Variable: EDUCATION					
1	37	4.49	1.04	2	6
2	17	3.94	.97	3	6
3	19	4.42	1.12	3	6
4	24	4.63	.77	3	6
Variable: AGE					
1	37	22.78	3.65	19	33
2	17	22.53	3.95	19	36
3	19	22.53	2.78	19	29
4	24	21.71	2.35	19	29

Instrumentation

Standardized California Achievement Test and a Gates-MacGinitie Reading Test were administered as a pretest. An alternate form of the pretest was used as the posttest and administered at the end of the instructional time. A delayed posttest was also administered to each category of students (3 to 12 months later).

Two separate studies were conducted, using a mathematics course for one treatment and a reading comprehension course for the other. The courses were taught utilizing two different instructional delivery systems, CAI and PSI respectively.

Review of the California Achievement Test

Miriam M. Bryan (1978) and Frank B. Womer (1978) reviewed the CAT in The Eighth Mental Measurement Yearbook and they reported that the tests have been available to schools for about 45 years. These tests are rigorously developed, traditional norm-reference achievement tests. Tests are designed to cover all grade levels from 1 through 12 in five integrated and overlapping levels of tests. Womer reports:

> "The CAT's five levels provide for the deliberate overlap at grades 2, 4, and 9. This overlapping has permitted the development of a continuous score scale from grade 1 through 12, which makes it easy

> and appropriate to fit a level of test administration to student's average attainment level rather than chronological grade placement when deemed appropriate. This feature would seem to make the CAT particularly appropriate for a school administrator attempting to assess changes in basic skills attainment over time (p. 10)."

The tests cover reading, mathematics, and language skills which are designed to measure, evaluate, and analyze school achievement in terms of student performance. These tests are no longer used to diagnose, as claimed for earlier editions of the test.

Standardization

Standardization sample was selected by a two-stage method of stratified random sampling from public school districts enrolling more than 300 students and from Catholic schools. The public school population was stratified according to geographical region (4 levels), average enrollment per grade, community type (rural-urban-suburban), district size (large-small), and a measure of district social class. Catholic schools were stratified by enrollment, geographic region, and type of school (diocesan or private). The sampling technique provided for proportionate representation in the national norm of minority group students in the total population. The tests

were normed on 300,000 students in grades K through 12 in fall, 1984, and Spring, 1985 (Airasian, 1989; Wardrop, 1989).

Validity

Evidence of the content validity is based on the procedures followed in the development of the tests. Statistical data related to validity include intercorrelation coefficient for typical grades and item difficulties (percent of right responses) for individual items in both forms. The median of the within-grade (grades and levels not identified) correlations between reading and mathematics is .75; between reading and language, .79; and between mathematics and language, .75.

Reliability

Alternate-form reliabilities are reported for the total battery score, the three tests, the subtests, and spelling. The alternate-form coefficients for the total battery range from .86 to .96 and a median of .93. Specifically, for the reading, mathematics, and language tests coefficients range from .80 to .91, with a median reliability of .87 for language and reading and .855 for mathematics tests. However, for the subtests, the median reliabilities are lower: vocabulary, .84; comprehension, .79; computation, .81; concepts and problems, .82; auditing, .44; mechanics,

.84; usage, .68; and spelling, .78. The total battery and three test scores are adequate for individual measurement, but the subtests scores are suitable for group measurement only.

In their review Bryan and Womer reported that Levels 1 and 2 of the CAT reading tests, while well planned and well written, are subject some criticism. They argue that the vocabulary subtests are too easy to read. In the same way, the comprehension subtests present little challenge for the better readers. Likewise, the language tests also draw some criticism. They are too difficult for the lowest and highest grade for which they are designed. In contrasts, the items in the mathematics tests at the various levels provide comprehensive coverage of the entire school program in general mathematics.

In sum, the CAT is a well conceived and well executed. With several exceptions noted, the items meet the content requirements and difficulty levels appropriate for the grades for which they are intended. Test booklets are designed in good taste, and accessory materials and special reports forms easy to use and interpret. It is one of the better batteries of its kind (Airasian, 1989).

Gates-MacGinitie Reading Test

The Gates-MacGinitie has a long history. This reading test dates back to the Gates Reading Test of 1926. According to the publisher, the Gates-MacGinitie is the most widely used reading test in the country. The present edition reflects the features of accepted contemporary standardized test of reading. However, the tests measures a limited domain of reading skills (Calfee, 1985).

Vocabulary subtests for levels A, B, and C use the identical item format as in the earlier edition of the Gates-MacGinitie Reading test (prior to the study). The A and B levels present a picture and a set of four words from which students must select the word that best describes the picture. Level C requires that the student select from four choices a word or phrase that means most nearly the same as the test word. Likewise, the item format for levels D through F are identical to level C, except that there are five words or phrases from which the student is to select a response.

Vocabulary words in each test level were selected from a variety of word list sources: Harris-Jacobson Core Words for first grade; Barnes' Revised Dolch List of 193 Words; Dale List of 769 Words; and American Heritage Word

Frequency Book. Words were selected to characterized those likely to be found in reading materials in the grade range covered by each test level (Rupley, 1985).

Validity

Two steps have been taken to establish validity in this battery. First, standards word lists were consulted in selecting the words for the vocabulary subtests. Second, the texts at each level were selected according to design that goes from simple stories in the primary grades to expository writing in the various disciplines at the latter levels.

Reliability

Reliability coefficients for internal consistency Kuder-Richardson Formula 20 (KR20) are presented for each test level and form: vocabulary reliability range from .90 to .95 and comprehension coefficient range from .88 to .94 (Rupley, 1985).

Correlation between the vocabulary and comprehension subtests is high, ranging from .71 to .87. The correlation between vocabulary and comprehension subtests is as high as correlations between two forms of the same subtest. At Level A, the vocabulary subtest of Form I has .88 correlation with the vocabulary of subtest Form 2; this .88 correlation is not much higher than the correlation of .86

between vocabulary and comprehension subtest on Form I. For Levels A to F, split-half reliability coefficients for vocabulary range from .85 to .94 and for comprehension from .85 to .92 (Dreher, 1985).

Norming Procedures

The Gates-MacGinitie Reading Test comes in two versions. A U.S. Edition and a Canadian Edition. Dreher (1985) reports that the U.S. version measures basically the same items that does the Metropolitan Achievement Test at 5th-grade and 8th-grade. The U.S. version was normed on a representative national sample of students and schools in the 1987 school year. This national norms are designed to meet federal guidelines for Chapter 1 (Title 1) evaluation (The 1990 Riverside Test Resource Catalog). These tests provide continuity of content and norms from level to level for easy measurement of status and growth and for comparison of groups at different levels. Pflaum (1985) explains that to construct the Canadian tests, the norming procedures used 46,000 students from 10 providences and the Yukon Territory. This edition has a Kuder-Richardson Formula 20 reliability coefficient ranging from .85 to .94 (U.S. .88 to .95).

A review of the literature on this instrument suggests that the Gates-MacGinitie Reading Test is well suited

device for the assessment of reading skills. The authors have given attention to past criticism and made changes accordingly. The teacher's manual is comprehensive and better written than the manual for early editions. As a measure of student's reading ability for evaluation purposes, the Gates-MacGinitie functions well. However, for the purpose of diagnosing it lacks the specificity needed to identify weaknesses; therefore, it serves best as a survey test to identify students for whom diagnostic testing is warranted (Rupley, 1985).

The application of the instruments used in this study will be detailed in three parts. Part one is Computer-Assisted Instruction, part two addresses Individualized Personalized Instruction, and part three deals with the student questionnaire.

Computer Assisted Instruction (CAI)

A pretest, posttest and delayed posttest quasi-experimental design was used to study four math groups. The first measure of mathematics achievement was Part 6 of the California Achievement Test (CAT). This part, entitled Mathematics Computation, comprised the multiplication, division, addition, and subtraction part of the test. The

study used forms C and D, levels 15, 17, and 19. This computations measure had 40 multiple choice items timed at 20 minutes.

The second measure was Mathematical Concepts and Applications (Part 7 of the CAT). This section had 85 multiple-choice items. The measure was timed at 35 minutes. This measure covered equations, conventional problem solving questions (essay type) and graphing exercises.

Personalized System Instruction (PSI)

The first measure for the PSI treatment was the Vocabulary part of the Gates-MacGinitie Reading Test developed by Walter H. MacGinitie. This test has three subtests - speed and accuracy, vocabulary, and comprehension - which provided data relevant to the general gains, or the degree to which the skills learned by the students transfer to other reading situations. The study used Form 2 of the Gates-MacGinitie levels D, E, and F. This measure had 45 multiple-choice items timed at 20 minutes.

The second measure, Reading Comprehension, had 43 multiple-choice items timed at 35 minutes. The ample time was allotted for the completion of the examination.

Questionnaire

In order to further assess the impact of two training procedures on gain scores in general mathematical and reading ability, a supplementary data collection and analysis effort was conducted. A questionnaire was administered to the entire sample in this study.

The main purpose of the questionnaire was to gather additional information to increase understanding of the subjects' test results and validate the data at hand. A secondary purpose was to better understand the effects of the program on the daily work performance, quality of work life, the subjects views toward education, and appraise the way he felt about himself and the future. The instrument probed the following areas: post program graduation continuing education, nature of work performed after graduation, students self-esteem level (before/after training), and demographical data.

This structured questionnaire (Appendix B) was used to conduct person-to-person interviews of the graduates of the Navy's Functional Skills Program. All ninety seven students participated and ninety seven questionnaires were completed. These person-to-person interviews and other

demographic information on file obtained on each of the study participants at the main office of the Navy Campus Program yielded twenty-seven variables.

Description of Questionnaire

The questionnaire consisted of four sections - background, quality of work life, personal profile, and demographical data. The background section presented general questions about work, attitudes toward the program, and experiences after completing the program. Perceived work performance changes were addressed in the quality of life section. The personal profile dealt with how the subject viewed himself, his feelings, and attitudes toward the future. The demographic information included information on gender, work performed, income, subject's education, parent's education, religious preference, age, and ethnic identification. Before utilizing the questionnaire in the person-to-person interview, the instrument was administered to functional skills students in the program. This test allowed for the rework of any problems in design. Feedback from these participants was incorporated into the revised questionnaire (Appendix B).

Procedures used in Collecting the Data

The study used the Navy Educational Services Office (ESO) and the Naval Educational Support Center, Atlantic,

Norfolk, Virginia, where these service members were stationed to administer the California Achievement Test (CAT), the Gates-MacGinitie Reading Test or other tests, as necessary. The program offers an average of 20 classes per year.

The California Achievement Test (CAT) was administered to the mathematic's students as a diagnostic pre-test. Likewise, Gates-MacGinitie Reading Test serve as a pretest for the PSI students. A nine weeks course followed with a posttest (alternate form of the pretest) administered at the end of the instructional unit. Using pre-set timed intervals (3, 6, 9, & 12 months) students were then given a delayed posttest. The data was gathered in the the following manner: study group 1, with a (October-November 1987) posttesting date took a delayed posttest three months after they had finished training (January-February 1988). Group 2 (August-September 1987) and group 3 (June-July 1987) delayed posttesting testing took place in March-April 1988 or six and nine months after they had finished, respectively. Delayed Posttesting for group 4 (April-May 1987) graduates took place in April and May 1988. This design is shown in Table 1.

Subsequent to the initial day of data collection, the researcher met with functional skills teachers to determine

proper protocol for the tests. The research protocol was briefly explained and the facilitators were given the opportunity to ask questions and make decisions regarding test protocol. The selected teachers agreed to follow a set test protocol.

The testing protocol called for the administration of academic tests in the morning of the designated test date. This sequence was followed by individual person-to-person interviews at pre-scheduled times (approximately from 10 A.M. to 4 P.M.) that same day. Each interview lasted approximately ten to twenty minutes.

Data Collection

On the designated test day, the investigator met with each selected test group in the morning. The test site was the Naval Education and Training Support Center (Atlantic), building Z-86, Naval Station, Norfolk, Virginia. The Standard California Achievement Test and the Gates-MacGinitie Reading Test were administered in the morning. Tests were administered on a self-scoring/self-grading answer sheet. Answer sheets were graded immediately by the teachers and data entered by the investigator directly into the computer at a later date using Number Cruncher Statistical System version 5.01.

This procedure was followed by a structured person-to-person interview at a pre-determined time agreed by researcher and participant (10 A.M. to 4 P.M.).

Once the questionnaire was completed, the researcher entered the information directly into the computer in order to conduct statistical analysis on the data, using Number Cruncher Statistical System version 5.01 (Hintze, 1987).

Data Analysis

A two-way within subjects ANOVA (Achievement x Time) with repeated measures on the time factor was used to analyze the data. Achievement (pretest, posttest and delayed posttest) was the within factor and Levels of Time (students divided into groups of 3 to 12 months since graduation) was the between factor. The mean scores are given in Table 5 and Table 10.

Post hoc Comparison

Post hoc comparison was applied to the CAI and PSI data in order to determine exactly where the significant differences existed. Fisher's least significant difference comparison (LSD) statistical analysis was utilized in post hoc contrasts of the group's pretest, posttest and delay posttest mean scores. A significant F ratio was identified and each possible pair of means were analyzed using post

hoc statistical procedures. The main purpose was to find out which, if any, of the means were significantly different from one another. The results of these analysis are reported in chapter 4.

Chapter 4

Analysis of Data

Introduction

The purpose of this chapter is to report the results of the statistical analysis of the two studies. The chapter is divided into four sections: (1) overview of the study, (2) Computer-Assisted Instruction study results, (3) Personalized System Instruction study results, and (4) questionnaire.

The limited time series investigation involved two separate studies, a mathematics skills component and a reading comprehension skills component of the Navy Campus Functional Skills Program 1987 graduates. A quasi-experimental design was used in two studies using two different pedagogical strategies. The mathematics course used Computer-Assisted Instruction and the reading comprehension course utilized Personalized System Instruction (PSI) methodology. The study was conducted onboard the Naval Station, Norfolk, Virginia. Sample size was ninety seven (N = 97) subjects. The sample was the same for both the mathematics and reading comprehension instructional units. Instructors were functional skills teachers, who were experienced in CAI and PSI methodology. The program averaged 20 classes per year.

Sample

Subjects were mostly low income (under $7,000) male caucasians with a history of educational problems: low achievers attempting to meet the minimum requirements to obtain a High School Equivalency (GED) diploma, persons whose English Comprehension Level (ECL) scores were considered inadequate, or personnel preparing to re-take the Armed Services Vocational Aptitude Battery (ASVAB). The mean age was 23 years. Table 2 in Chapter 3 summarizes descriptive data of the sample.

The purpose of this research was to investigate the long-term (three to twelve months) mathematics and reading comprehension skill retention of Navy Campus Functional Skills program graduates.

The investigation made use of two-way analysis of variance (ANOVA) with repeated measures to explore three questions:

1. Is there a significant difference between the overall row means?
2. Is there a significant difference between columns means?
3. What is the interaction of individual cells within the diagram?

Computer-Assisted Instruction

A pretest, posttest, and delayed posttest quasi-experimental design was used to study four math groups. Students were divided into groups (levels of time) according to the length of time elapsed since their graduation from a 45-day unit of instruction. The analysis studied the skill retention levels of this CAI course in math across different levels of time (3 to 12 months).

The California Achievement Test (CAT) was administered to the mathematics students as a diagnostic pre-test. A nine weeks course followed with a posttest (alternate form of the pretest) administered at the end of the instructional unit. Using pre-set timed intervals (3, 6, 9, & 12 months) students were then given a delayed posttest. Descriptive data shown in Table 3. Means shown are grade level equivalent for the California Achievement Test.

Table 3

Math Groups Descriptive Statistics

Time	N	Mean	Std.Deviation	Min.	Max
Variable: MATHEMATICS PRETEST					
1 (3 mo)	37	8.68	1.59	4.8	12.5
2 (6 mo)	17	8.52	1.49	6.3	11.1
3 (9 mo)	19	8.27	1.93	5.1	12.5
4 (12 mo)	24	8.98	1.80	6.3	12.5
Variable: MATHEMATICS POSTTEST					
1 (3 mo)	37	10.32	2.00	6.5	12.6
2 (6 mo)	17	10.21	1.99	6.7	12.5
3 (9 mo)	19	9.96	1.95	6.6	12.5
4 (12 mo)	24	10.47	1.84	6.7	12.5
Variable: MATHEMATICS DELAYED POSTTEST					
1 (3 mo)	37	9.47	2.20	5.7	12.5
2 (6 mo)	17	9.83	2.06	7.0	12.7
3 (9 mo)	19	9.46	1.92	6.6	12.5
4 (12 mo)	24	10.28	1.95	7.7	12.7

CAI Data Analysis

A two-way within subjects ANOVA (Achievement x Time) with repeated measures on the time factor was used to analyze the data. Time (pretest, posttest and delayed posttest) was the within factor and Levels of Time (students divided into groups of three to twelve months since graduation) was the between factor. Table 4 shows the results of the statistical analysis. These results will be discussed as they address each research question.

Table 4

Analysis of Variance (ANOVA) Report

	Mathematics Computer-Assisted Instruction				
Source	DF	Sum-Square	Mean Square	F-Ratio	Prob > F
A (Group)	3	15.55	5.18	0.61	0.6100
S (A)	93	789.72	8.49		
B	2	132.06	66.03	54.02	0.0000
AB	6	4.26	.71	0.58	0.7453
Error	186	227.36	1.22		
Total	29	1166.95			

Factor A: Group Factor B: Pre-, posttest, delayed posttest

Research Question #1

> Will there be significant differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction?

The mean scores for each math group in the study were compared (shown by Table 4 and Table 5). Significant differences between the overall row means and the overall column means (question 1, page 71) would indicate the presence of a significant main effect. The mathematics results disclosed a significant main effect between the pre- and posttest data. This indicated that learning took place in the CAI treatment. The data obtained showed that there is no evidence of statistically significant difference between the mean scores of the four groups $F(3, 93) = .61$, $p = .6100$. However, there was a need to determine the effects of time on the groups' performance. The interaction of the groups from posttest to delayed test would determine the exact effects of time, if any, on the CAI treatment.

Table 5

Mathematics - Computer-Assisted Instruction Group Means

			PRETEST	POSTTEST	DELAYED
T	3 mo	n =	37	37	37
	G 1	x	8.68	10.32	9.47
I	6 mo	n =	17	17	17
	G 2	x	8.52	10.21	9.83
M	9 mo	n =	19	19	19
	G 3	x	8.27	9.96	9.46
E	12 mo	n =	24	24	24
	G 4	x	8.98	10.47	10.28

Research Question #2

> Will there be significant differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

Based on the statistics presented in Table 4, there is a significant difference $F(2, 186) = 54.02$, $p < .00005$) between the pretest, posttest, and delayed posttest (repeated measures). There is no evidence of an interaction $F(6, 186) = .58$, $p = .7453$. The means of the achievement test results suggested that learning declined over time (posttest to delayed). In order to determine the specific nature of the significant difference the means of the groups were further analyzed by post hoc comparison test.

Post hoc Comparison

Fisher's LSD multiple comparison report was used in post hoc contrasts of the math group's pretest, posttest and delayed posttest mean scores. Results are shown on Table 6.

Table 6

Fisher's LSD Comparison Report

Mathematics Computer-Assisted Instruction		
Summary of Results (p= .05)		Level Codes
Code (Level)	Mean	ABC
A (PRETEST)	8.65	.SS
B (POSTTEST)	10.27	S.S
C (DELAYED)	9.73	SS.

The means of the levels of the selected factors are sorted and listed. The smallest is given the code A, the next B, and so on. Each row of the report ends with a dot and S's. An S indicates that this mean is significantly different from the level whose code is above it.

Once a significant F ratio had been identified, multiple comparisons (post hoc) statistical analysis were applied to the data in order to determine exactly where the significant differences existed. Each possible pair of means were analyzed using post hoc statistical procedures to find out if the means were significantly different from one another. Thus, Fisher's least significant difference comparison was applied to the math groups using CAI instructional modality. No significant differences in the means of the four groups were ascertained. That is, the overall groups' performance was equally balanced. Nevertheless, the analysis report indicated statistically significant difference between the posttest and delayed test mean scores (shown by Table 6). Moreover, the ANOVA showed a numerical decrease between posttest (10.27) and delayed posttest group mean scores (9.73). This factors prompted further analysis of the data.

Two-way Analysis of Variance

In order to determine the implications of the post hoc analysis a two-way ANOVA was conducted. The test used a two by four design. Groups were the dependent variable and the independent variables. The two-way ANOVA supported the findings of the repeated measure ANOVA and the post hoc

test. That is, the two-way analysis showed significant difference between the post and delayed test scores. This produced evidence which suggests the decline of math skills over time in the case of the CAI treatment groups. The analysis data is presented in Table 7.

Table 7

Two-way Analysis of Variance (ANOVA) Report

	Mathematics Computer-Assisted Instruction				
Source	DF	Sum-Squares	Mean Square	F-Ratio	Prob > F
A (Group)	3	10.75	3.58	0.51	0.6761
S (A)	93	653.17	7.02		
B	1	13.94	13.94	13.45	0.0004
AB	3	3.43	1.14	1.10	0.3526
Error	93	93.41	1.04		
Total	193	777.70			

Factor A: Group Factor B: Posttest, delayed posttest

Personalized System Instruction (PSI)

A pretest, post and delayed posttest quasi-experimental design was used to study four reading comprehension groups. The modality of delivery for these groups was Personalized System Instruction (n = 97) which made use of individual drill and homework exercises as well as teacher lecture, presentations, and textbook assignments. A summary of the data is contained in Table 8. Means reported are grade level equivalent for the Gates-MacGinitie Reading Test.

Table 8

Descriptive Data

Time	Pop	Mean	Std. Deviation	Min.	Max
Variable: READING PRETEST					
1 (3 mo)	37	9.66	1.94	6.1	12.9
2 (6 mo)	17	10.51	1.85	6.0	12.9
3 (9 mo)	19	10.61	1.58	7.6	12.9
4 (12 mo)	24	10.25	1.78	6.0	12.9
Variable: READING POSTTEST					
1 (3 mo)	37	10.27	1.64	7.1	12.7
2 (6 mo)	17	10.98	1.46	7.2	12.7
3 (9 mo)	19	11.26	1.15	8.9	12.7
4 (12 mo)	24	10.98	1.69	5.8	12.7
Variable: READING DELAYED POSTTEST					
1 (3 mo)	37	9.99	1.64	5.3	12.7
2 (6 mo)	17	11.06	1.31	8.6	12.7
3 (9 mo)	19	10.92	1.38	8.8	12.7
4 (12 mo)	24	10.76	1.56	6.5	12.7

PSI Data Analysis

A two-way analysis of variance - ANOVA (Achievement x Time) with repeated-measures on the time (pre, post, and delayed posttest) was utilized to analyzed the data. The within factor was time (pre-, post, and delayed posttest) and the between factor was the levels of time (groups). In order to determine any significant changes in the test performance of students taught reading comprehension using PSI, the mean scores of the specific groups were compared and analyzed through repeated measures analysis of variance (shown in Table 9).

Table 9

Analysis of Variance (ANOVA) Report

Reading Comprehension - Personalized System Instruction					
Source	DF	Sum-Squares	Mean Square	F-Ratio	Prob > F
A(Group)	3	49.61	16.54	2.62	0.0554
S (A)	93	586.97	6.31		
B	2	19.23	9.62	11.42	0.0000
AB	6	1.24	.21	0.25	0.9606
Error	186	156.63	.84		
Total	29	813.68			

Factor A: Group Factor B: Pre-, posttest, delayed posttest

Research Question #3

> Will there be significant differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction?

Again, the mean scores for each reading group in the study were compared (see Table 9 and Table 10). The two-way analysis of variance (ANOVA) data in this study showed that there was no evidence of significant difference between the mean scores of the four groups $F(3, 93) = 2.62$, $p = .0554$. Notwithstanding, there was a significant difference in group performance between pretest and posttest. This indicated a significant main effect. That is, the PSI treatment was effective and learning took place from pre- to posttest. Moreover, to determine the effects of time (the interaction) on reading skills, the posttest data was compared against the delayed test results and further analyzed using post hoc comparison.

Table 10

Reading - Personalized System Instruction Group Means

			PRETEST	POSTTEST	DELAYED
T	3 mo	n =	37	37	37
	G 1		9.66	10.27	9.99
I	6 mo	n =	17	17	17
	G 2		10.51	10.98	11.06
M	9 mo	n =	19	19	19
	G 3		10.61	11.26	10.92
E	12 mo	n =	24	24	24
	G 4		10.25	10.98	10.76

Research Question # 4

Will there be significant differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

There was a significant difference F (2, 186) = 11.42, p = < .0005) between the pretest, posttest, and delayed posttest (repeated measures). This indicated the presence of a significant main effect (i. e. learning took place between the pretest and posttest). Thus, the PSI treatment was effective during the training period (pre- to posttest). On the other hand, there was no evidence of an interaction F (6, 186) = .25, p = .9606. Still, a contrast of the mean scores showed a decrease in delayed mean scores (10.55) when contrasted with posttest mean scores (10.76), whereas the analysis of variance indicated no statistically significant difference in the contrast between posttest and delayed test results. This ambiguity prompted that the data was furthermore investigated by means of post hoc tests, as shown by Table 11.

Table 11

Fisher's LSD Comparison Report

Reading Comprehension Personalized System Instruction		
Summary of Results (p = .05)		Level Codes
Code (Level)	Mean	ABC
A (PRETEST)	10.14	.SS
B (POSTTEST)	10.76	S..
C (DELAYED)	10.55	S..

The means of the levels of the selected factors are sorted and listed. The smallest is given the code A, the next B, and so on. Each row of the report ends with a dot and S's. An S indicates that this mean is significantly different from the level whose code is above it.

Post hoc Comparison

Fisher's LSD comparison report was used in post hoc contrast of the PSI groups' pre-, post, and delayed posttest mean scores.

In the personalized System Instruction mode a significant F ratio was identified and multiple comparison (post hoc) statistical analysis applied to the data in order to determine exactly where the significant differences existed. Each possible pair of means was analyzed using post hoc statistical procedures to find out if the means were significantly different from one another. Fisher's (LSD) comparison was applied to the reading comprehension data. No significant differences in the means of the four groups were discovered. Post hoc summary revealed statistically significant differences between the pre- and posttest and the pre- and delayed test as well, but no significant difference was detected between the delayed test and posttest. In sum, notwithstanding the numerical difference, no statistically significant difference was found by the reading course post hoc comparison test, other than that attributed to the instruction itself.

A two-way analysis was conducted using the posttest and and delayed test data in a two by four format in order to exhaust all possible avenues of analysis. The two-way analysis of variance with repeated measures and the post hoc findings were further substantiated by a two-way analysis of variance. This analysis conducted between the post and delayed test upheld that no significant differences existed between the two tests. However, this additional analysis showed a significant main effect for the groups, $F(3, 93) = 2.83$, $p = .0429$. Table 12 supports these findings. Several reasons may have contributed to this effect. They main effect among the groups may be a result of individual differences among the members of each group. Another reason may be that the members were assigned to the groups based on the time they participated in the program as opposed to selection based on each individual's ability. One possible explanation for this effect is research error. Research error is always a problem when one uses intact groups rather than random selection or ability grouping. Inasmuch as all groups were not significantly different on their pretest scores, they at least started the unit of instruction equally.

Table 12

Two-way Analysis of Variance (ANOVA) Report

Reading Comprehension - Personalized System Instruction					
Source	DF	Sum-Squares	Mean Square	F-Ratio	Prob > F
A(Group)	3	34.52	11.51	2.83	0.0429
S (A)	93	378.64	4.07		
B	1	2.19	2.19	3.56	0.0624
AB	3	1.01	.34	0.55	0.6512
Error	93	57.18	.61		
Total	193	473.54			

Factor A: Group Factor B: Posttest, delayed posttest

Questionnaire

A structured questionnaire (Appendix B), consisting of four sections: background, quality of work life, personal profile, and demographical data, was used to conduct person-to-person interviews of former graduates (N = 97) of the Navy's Functional Skills Program. Ninety seven students participated and ninety seven questionnaires were completed.

The demographic information included information on gender, income, subject's education, parent's education, religious preference, age, and ethnic identification. Supplementary statistical information was also obtained from class rosters, registration forms, and other public records available at main Navy Campus Office, Naval Amphibious Base, Norfolk, Virginia. The questionnaire and the supplementary information yielded 27 variables.

The information provided by the additional information and the person-to-person interview assisted in analysis of the empirical data provided by the tests and the answers to the research questions.

Research Question # 5

Will Computer-Assisted Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

The study also investigated the effects of computer-Assisted Instruction (CAI) program on basic skills achievement and attitudes toward instruction. Some positive effects on students' feelings about the CAI technology and about themselves are suggested in this study.

1. The study found that many students (65 percent) entering the computer-assisted math treatment had expressed high levels of math and computer anxiety.

2. Students were able to adjust to the special environment of computer work and to derive benefits from the technology.

3. Development of computer literacy provided a potential source of positive affective development for the students as well as mastery of the subject matter content.

4. The nonjudgmental, neutral, and consistent reinforcement offered by the computer offered the optimal reward situation and contributed to positive attitudes on the part of the students.

5. The privacy of the CAI situation reduced and provided freedom from embarrassment, disapproval, or diminished status often found with making a mistake in the classroom.

6. Reduction in negative feedback allowed students to learn through trail and error at his or her own pace.

Research Question # 6

Will Personalized Systems Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

The questionnaire made it possible to study the effects of Personalized System Instruction on the students' basic skills achievement and attitudes toward instruction. Some positive effects on students' feelings and attitudes about themselves were noted, these are:

1. Mastery of reading skills provided a source of positive affective development for the students which facilitated the students' understanding of the technical aspects of their jobs (achieve competency), improve the quality of their work life (reported by supervisors during interviews), and encouraged them to seek new reading challenges.

2. External support, especially in the form of supervisory praise for improved work quality, contributed to the development of positive attitudes about life and work itself.

3. The reading modular approach offered a positive reward situation that encouraged the students to continue reading improvement.

Summary of Findings

Computer-Assisted Instruction

The Computer-Assisted Instruction (CAI) was used in this study to teach mathematics skills in this unit of instruction. The findings were:

1. Sixty-five percent of the students reported that they were intimidated by the computer.

2. Students reported that less than 20 minutes per day were spent preparing for the class at the end of each instructional time. Effective study time was limited to the classroom, since none of the students had access to a personal computer. Out of the class 80 percent reported spending 1 hour per week in preparation for the course.

3. Ninety-five percent of the participants reported they had not practiced the mathematics skills after graduation, simply because this was not part of their everyday work experience.

4. The CAI treatment was effective and learning took place between pre- to posttest.

5. There was a decline in learning over time (posttest to delayed test). However, a one grade-level improvement was registered between pretest (8.65) to delayed test (9.73).

Personalized System Instruction

The Personalized System Instruction (PSI) was used with the reading comprehension unit of instruction. The findings were:

1. Sixty-eight percent of the students percent reported the PSI mode required an average of three to four hours of study time per week.

2. Sixty-five percent of the students complained that the Government furnished materials were not good indicators of the student's reading progress because they contained information which they knew by other means, such as work related experiences.

3. Students felt at ease with the PSI strategy (there were no reported attitudinal or psychological threads reported by the students).

4. Reading skills were easily retained because they were practiced on daily basis (reading newspapers, magazines, etc.).

5. Progress under the Gates-MacGinitie Reading Test were hard to assess at the higher levels (12.5 and over) due largely to the way the tests were normed, which limited to 12.7 the highest score on alternate forms of the test.

6. The PSI treatment was effective and learning took place from pretest to posttest. Moreover, reading skills were sustained over time, pretest (10.14) to delayed test (10.55).

Summary

Two null hypothesis were tested. Specifically, this study hypothesized that the math and reading treatments would result in significant differences in scores between the pre- and the posttest and no significant differences between posttest and delayed test. To this end, this study explored the following two null hypothesis:

Hypothesis 1: There will be no statistically significant difference between posttest and delayed posttest scores with Computer-Assisted Instruction (CAI).

The results of the study were analyzed by a two-way analysis of variance with repeated measures. Each subject's responses to the pre-, posttest, delayed posttest were scored and means given were contrasted.

Analysis of these data revealed a significant main effect and an interaction with time for the mathematics treatment under CAI. The CAI delivery system showed

significant difference between the pretest and posttest as well as between the posttest and delayed test. Contrasts of the CAI means revealed that the treatment was effective and that learning was present between the pretest to posttest period. But, learning declined over time from posttest to delayed test.

Hypothesis 2: There will be no statistically significant difference between posttest and delayed posttest scores with Personalized System Instruction (PSI).

The results from an analysis of the research questions posed in this study indicated a significant difference between pretest and posttest performance in the Personalized System Instruction groups.

Analysis of the data revealed a significant main effect and but no interaction with time in the reading comprehension treatment groups using PSI. PSI delivery system showed significant difference from pretest to posttest scores and no significant difference between posttest and delayed posttest scores. Contrasts of the PSI means revealed no changes in reading skills over time.

CHAPTER 5

Overview, Conclusions, Recommendations, and Summary

Overview

Today one-in-five Americans (27 million) are functional illiterates (Weir, 1986; Harmon; 1986; Irwin, 1987; Cavazos, 1990). Most astounding is that many have completed high school. However, they are unable to use printed and written information, develop their knowledge and potential, and fully function in society. Illiteracy reduces the Gross Nation's Product (GNP) by more than $100 billion per year (Kozol, 1985; Irwin, 1987). Three-out-four major American corporations find it necessary to train new workers in basic reading, writing, and arithmetic (Whitman, 1989; Weir, 1986). The military is also experiencing similar difficulties. In response to training problems, military officials have initiated a number of functional literacy programs. The Navy Functional Skills Program is one example.

The purpose of this study was to assess the long-term (3 to 12 months) mathematics and reading comprehension skill retention of the Navy's Functional Skills Program graduates. The knowledge gained from this investigation is designed to provide insights for the Navy Campus

Functional Skills administrators who must make informed decisions about future functional skills program development.

In conducting this study, the following research questions were addressed:

1. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction?

2. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught mathematics using Computer-Assisted Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

3. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction?

4. Will there be differences in the pre-, posttest, and delayed posttest performance scores of students taught reading comprehension using Personalized System Instruction when contrasted across levels of time (3, 6, 9, & 12 months)?

5. Will Computer-Assisted Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

6. Will Personalized Systems Instruction have an effect on the students' basic skills achievement and attitudes toward instruction?

Two separate studies were conducted. One studied the effects of Computer-Assisted Instruction (CAI). The other study investigated a Personalized System

Instruction (PSI) similar to the Kellar plan. The mathematics testing utilized alternate forms of the California Achievement Test. Reading level was assessed with the Gates-MacGinitie Reading Test. Ninety seven subjects (N = 97) were divided into groups (levels of time). Groups were formed based on the length of time elapsed since graduation. The intent was to validate the posttest gain scores after a 3 to 12 month time lapse. The sampled students were divided into the following groups:

Group 1 - students 3 months from graduation.

Group 2 - students 6 months from graduation.

Group 3 - students 9 months from graduation.

Group 4 - students 12 months from graduation.

The sampled groups were the same for both the mathematics and reading comprehension course. Courses were eight weeks in duration.

The students taking the instructional units were primarily low academic achievers attempting to meet the minimum state requirements for a High School Equivalency Test (GED), naval personnel whose English Comprehension Level (EGL) scores were considered inadequate, or personnel preparing to re-take the Armed Services Vocational Aptitude Battery (ASVAB). The sampled

students were mostly caucasians from low socio-economic background with a median age of 23 years.

A quasi-experimental design using pre-, post, and delayed posttest with a two-way within-subjects ANOVA (Achievement x Time) with repeated measures on the time factor was used to analyze the data. The within factor was time (pre-,post, and delayed) and the groups the between factor. Fisher's Least Significance Difference (LSD) Test was used in post hoc contrast of the group's pre-, post, and delayed posttest mean scores.

In order to further assess the impact of the two training procedures a supplementary data collection and analysis was conducted. This endeavor took the form of a questionnaire administered orally to the subjects by the researcher. The results were analyze in order to determine significant differences in retention of skills between groups over time.

Conclusions

Computer-Assisted Instruction

Hartley (1977) using research synthesis showed that computer-assisted instruction was one of the most effective ways of teaching mathematics. This study

revealed that computer-assisted instruction may not be effective without special consideration of some important factors.

The factors which require special consideration to establish a computer-assisted class are:

1. CAI had a differential effect on students' attitudes toward the subject matter.
2. The Computer-Assisted Instruction limits out of class opportunities when equipment is not available.
3. Computer-based approach can produce a substantial saving in instructional time.
4. Many students were intimidated by the computer.

The Computer-Assisted Instruction mathematics course produced some interesting results. The evidence indicates that learning was achieved and that CAI treatment was effective. This is because of the significant main effect produced between the pretest and posttest scores, where the math class showed an increase of close to two grade-levels (8.65 to 10.27). Another result was the effects of time on math skills. The analysis of the data showed a decline in learning from posttest (10.27) to delayed test (9.73). This factor, if considered alone, suggests that the math treatment may have been ineffective over time. Yet, this conclusion may be deceiving. Contrast of the pretest

(8.65) mean score and the delayed test mean score (9.73), revealed a one grade-level improvement. This indicates that, on a limited scope, math skills were retained over time. A possible explanation for the decline of math skills could have been the lack of opportunities for the practice of those skills after the training (Milkovich & Glueck, 1985).

Finally, the data considered did not produce evidence to determine the exact moment in time when these math skills began to decline. It seems likely to this researcher that the decline in math skills occurred within the first ninety days following the training. This may be an area for further study and consideration in future research on the topic.

Personalized System Instruction

Based on the PSI findings the following conclusions are reported. Personalized System Instruction revealed:

1. Personalized System Instruction assisted the student in organizing his thoughts into a logical sequence of events.

2. On the average, the additional time required by PSI could be easily accomplished.

3. PSI presented instructional material in a non-threatening (man versus machine) and in a user friendly modality.

4. The PSI group retained equal or higher performance scores on the delayed posttest, when contrasted with the posttest.

The students complained that the Navy-furnished instructional material was disorganized, too easy to learn, and did not challenge the student enough. Many stated that they could not rate their progress in the program, since most of the reading materials presented were based on information that most sailors know by simply being in the Navy and not by reading the information in the reading workbooks. In their view, this made self-assessment an impossible task. During the interviews, students presented concerns about the lack of effectiveness and motivation associated with the intergroup competition of small cooperative groups, such as the ones associated with a conventional lecture-discussion-recitation system.

The reading comprehension course proved to be effective. PSI modality produced evidence of a significant difference between pretest (10.14) and posttest (10.76) scores. This showed clear evidence that the students learned and improved their skills under this treatment. However, the data showed no evidence of significant changes over time in reading skills from posttest (10.76) to delayed test

(10.55). Nevertheless, the evidence did show that the students retained their general reading ability, pretest (10.14) to delayed (10.55).

Practice effects of informal reading activities and the self-motivating effect of skill development may be offered as explanatory mechanisms for sustaining these skills over time. This could be because reading practice is an excellent approach for improving the reading ability of beginning-level readers (below 5th-grade), but for advanced level readers such practice is not likely to be effective. The general improvement of reading skills over time by a new reader is expected and is a fact well established in the literature on the subject (Carver, 1977; Calfee & Piontkowski, 1981; Carver & Hoffman, 1981).

Reading is an everyday event for readers. According to Carver & Hoffman (1981) one possible explanation for this finding is that gains in general reading ability depends upon different factors during the progress stages. They identify two phases of progress in reading, a beginning and an advanced phase. The beginning phase develops until the student's reading grade-level reading ability reaches a 4th-grade. The advanced phase begins at 5th-grade reading level and above.

During the beginning phase, reading practice may facilitate progress. Students are learning to decode at this stage. Learning to comprehend written sentences that the student would have no trouble comprehending were these sentences presented auditorily. Another explanation may be that gains in reading ability are primarily associated with the successful decoding of written material. Extensive practice in decoding is a good solution to this problem (Carver, 1977).

In the advanced phase practice is not likely to be a productive procedure. Students whose reading ability is above the 5th-grade level improve their reading ability by increasing their knowledge and experiences. This is because the students are learning to comprehend sentences which they would have equal difficulty comprehending were they presented auditorily. Improvement in reading ability during the advanced phase does not come from practice of a skill, but rather from gain in knowledge acquired in any manner. In the end, research findings (Carver & Hoffman, 1981; Calfee & Piontkowski, 1981) indicate that practice may be a promising approach for improving the reading ability of individuals who are beginning-level readers. However, practice will not improve the student's reading ability in general.

It may be that practice will produce gain in general reading ability when paired with good listening skills and other experiences which enhance the student's general knowledge (Carver & Hoffman, 1981). It may also be the case that, practice of reading skills for the more advanced reader will maintain reading skills recently acquired. Again, the self-motivating effect of skill development (learning to read for the first time) may be offered as explanatory mechanisms for sustaining these skills.

Recommendations for Further Study

This study was conducted to investigate the long-term (3 to 12 months) mathematics and reading comprehension skill retention of Navy's 1987 Functional Skills Program graduates. The program's primary goal is to develop or improve those skills necessary for acceptable job performance, career advancement, success in future training programs, and to develop life-coping skills in Navy personnel. To this end, the following is suggested for further study:

1. Additional research could focus on each skill subtest to identify student's strengths and weaknesses, and

2. the effects of experience after remediation to determine what activities may build upon and strengthen the skills achieved, could be explored.

Recommendations for Practice

Staff Development Administrators would do well to understand the dynamics involved in computer-based instruction and reading courses in order to make informed decisions about future program development, including the psychological effects of computer and math anxiety on effective learning. To this end, they might:

1. Design and implement a computer literacy course for students preparing to enter the functional skills program. Require this instruction as a pre-requisite to the instruction. This may reduce computer anxiety.

2. Establish a tutorial service. This tutor service will provide a medium for students to air their academic problems.

3. Make use general knowledge reading literature. This will enable the student to conduct self-assessment. This provides a means for the student to map his progress and enhance his reading experience.

4. Design and implement follow-on mathematics modules. This approach may provide the necessary after training practice of math skills required to enhance math performance, especially since decline in scores seemed to occurred immediately following the training.

A greater effort must be made to identify successful educational strategies that enhance basic skills retention. The military and major corporations continue to spend vast

sums of money on remedial training, which suggests that many entry-level workers and recruits continue to lack sufficient basic skills pre-requisite to occupational success in a society depending increasingly on technology and other sophisticated skills. One problem is identifying the educational strategies which may facilitate the improvement and retention of these functional skills within the nation's workforce.

Summary

In sum, various educational strategies have been developed to counter the problem of retention of functional skills. This study looked at math skills taught by Computer-Assisted Instruction and reading skills taught by Personalized System Instruction. These two approaches when used to teach students to work individually improve their basic skills provide certain benefits. Positive results were found in the mathematics course using computer-based instruction. The foremost advantage of CAI strategies was that the teacher was freed from the boring task of reviewing and scoring the student's work. Hence, this time saved was dedicated to provide individual attention to those falling behind in their work. In addition, the teacher were better able to overcome the problem of adapting to

the student's changing performance. This is especially important during math drill problems, where the teacher had to decide instantly whether the student needs more such practice or could skip to the next level of problems. In Computer-Assisted Instruction information concerning the individual student's responses could be stored, retrieve, processed statistically, and reviewed by the teacher. Moreover, material was presented in nonverbal usage in the form of pictures or diagrams. Computers were programmed to respond much like a human beings and even use humor to encourage the student to continue on, even after an incorrect response. However, CAI learning had some drawbacks. One limitation is the transfer and application of problem-solving skills acquired on the computer to other lessons. Another drawback is how to integrate the computer into traditional lessons. Another weakness is the anxiety created by the computer technology on the students. Notwithstanding, students conquered these drawbacks through exposure and proper guidance.

Personalized System Instruction provided individualized reading instruction, extensive practice, and the motivation for the students to learn to read. One feature liked by the students enrolled in the PSI is the ability to learn to read at their own pace. Still, the

system also had some drawbacks: the lack of interaction between students and the ability to procrastinate were two limitations of this system highlighted by the students.

Computer-Assisted Instruction and Personalized System Instruction can improve learning and long-term retention when combine with teacher assistance. Even more, a curriculum based on computer learning and Personalized System Instruction can contribute to a better attitude toward school by instilling intangible skills such as pride, perseverance, and positive attitudes.

The data in this research suggests that attention to the learning process should not stop at the end of instructional experiences. Attention must be paid to those experiences after the learning experience which may contribute to retaining a level of skill previously achieved. Recognizing that the practice of skills may produce gain in general ability, when associated with good listening skills and other experiences which may improve a student´s general knowledge, more attention could be given to improving experiences particularly relevant to those skills which are not normally reinforced in the course of an individual´s daily routine, such as mathematics skills.

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Appendix A

DEPARTMENT OF THE NAVY

NAVAL EDUCATION AND TRAINING SUPPORT CENTER (ATLANTIC)
BUILDING Z-66, NAVAL STATION
NORFOLK, VIRGINIA 23511

IN REPLY REFER TO

1560
Ser N2
13 November 1987

DTC Pedro A. Cartagana
Navy Manpower Engineering
Center
Norfolk, VA 23511

Dear Sir:

Naval Education and Training Support Center, Atlantic (NAVEDTRASUPPCENLANT) provides two modes of delivery in the offering of functional skills to sailors. One mode is program instruction and the other is computer assisted instruction.

These two formats have been in place for a significant amount of time to warrant an in-depth research as to whether or not there is a long range retention effect or not. Does the functional skills program indeed offer a learning capability wherein the material that was learned is retained and used after twelve or eighteen months?

It would be very interesting to have a research study of the magnitude that you suggested completed.

Sincerely,

T. J. GRATTALONE, Ph.D.

DEPARTMENT OF THE NAVY

NAVAL EDUCATION AND TRAINING SUPPORT CENTER (ATLANTIC)
BUILDING Z-66, NAVAL STATION
NORFOLK, VIRGINIA 23511

IN REPLY REFER TO

1560
Ser 00/

24 NOV 1987

From: Commanding Officer, Naval Education and Training Support Center, Atlantic, Norfolk, VA 235LL-6197
To: DTC Pedro A. Cartagena, Navy Manpower Engineering Center, Norfolk, VA 23511

Subj: FUNCTIONAL SKILLS STUDY

Ref: (a) Your ltr of 30 Oct 87

1. Reference (a) requested authorization to conduct a study of the Navy Campus Functional Skills Program. I am pleased to approve your request and to wish you success in your endeavor in completing your dissertation and eventually your Ph.D.

2. I hope the information gained from your study will be of benefit both to you and the United States Navy. With that hope in mind, request a copy of your study be provided to this command.

3. If I can be of further assistance, please do not hesitate to contact me through my representatives at Navy Campus.

B. F. BAIL

Copy to:
NETPMSA (Code 04)

Appendix B

Confidential Questionnaire

I Background Information

Policy makers concerned with designing a comprehensive Functional Skills Program would like to better understand the effects of this program on your performance at work, the program's impact on the quality for your work life, and your willingness to further your education. Therefore, we would like to ask several questions about your work, your attitudes towards the program, and your experiences after completing the functional skills program.

1. I joined the U. S. Navy in order to: (Circle number)

   1 AVOID LEGAL PROSECUTION
   2 GET AWAY FROM HOME
   3 LEARN AN OCCUPATION
   4 DO SOMETHING WITH MY LIFE
   5 GET THE GI BILL (EDUCATION)
   6 FULFILL FAMILY EXPECTATIONS
   7 DROP OUT OF SCHOOL
   8 OTHER ...SPECIFY

2. The reason I entered the Navy Functional Skills Program was: (Circle number)

   1 I WANTED TO IMPROVE MYSELF (PERSONAL GROWTH)
   2 I EXPERIENCED SOME DIFFICULTIES AT WORK
   3 I WAS UNABLE TO READ/UNDERSTAND TECHNICAL MANUAl
   4 I WAS FORCED INTO THE PROGRAM BY MY SUPERVISOR
   5 TO IMPROVE MY ASVAP SCORES (LATERAL CONVERSION)

3. Since completing the Functional Skills Program I have completed the following number of high school level courses:

   1 NONE
   2 1
   3 2
   4 3 OR MORE
   5 COMPLETED THE GED (OBTAINED HS DIPLOMA)

4. Since completing the Functional Skills Program I have completed the following number of college level courses:

   1 NONE
   2 1
   3 2
   4 3 OR MORE
   5 COMPLETED A BS (OBTAINED A DEGREE)

5. Since completing the Functional Skills Program I have completed the following number of correspondence courses:

   1 NONE
   2 1
   3 2
   4 3 OR MORE
   5 OBTAINED DIPLOMA IN A TECHNICAL FIELD

6. My ASVAP retake scores increased by _____ upon completion of the Functional Skills Program.

7. My ASVAP retake score decreased by _____ upon completion of the Functional Skills Program.

II Quality of Work Life Information

Please answer the following statements by circling the answer that best fits how you feel. Select the statement that best applies to you from strongly agree to strongly disagree.

	Strongly agree				Strongly Disagree
1. I feel the Functional Skills Program improved my ability to do work (by improving my reading, writing and arithmetic skills).	1	2	3	4	5
2. I feel the functional Skills Program did very little to improve my abilities in reading, writing and arithmetic	1	2	3	4	5
3. I certainly feel the Functional Skills Program was the key factor in my increased ASVAP score and subsequent selection to a Navy class "A" school.	1	2	3	4	5
4. I feel the Functional Skills Program played an insignificant role in my ASVAP scores and subsequent selection to a Navy class "A" school.	1	2	3	4	5
5. I feel the quality of my work improved after completing the Functional Skills program.	1	2	3	4	5
6. The Functional Skills Program improved the quality of my work life (the working climate at my work center and the way I felt about work).	1	2	3	4	5
7. I feel good about the quality of my work.	1	2	3	4	5
8. I feel the quality of my work has decreased.	1	2	3	4	5

III Personal Profile

Another important part of the study is to ask some questions about how you view yourself. The personal profile will be addressed in two parts:

A. how you view yourself
B. feelings and attitudes about yourself and the future

Please answer the following statements by circling the answer that best fits how you view yourself. Select the statement that best applies to you from strongly agree to strongly disagree.

	Strongly agree				Strongly Disagree
1. I take a positive attitude toward myself.	1	2	3	4	5
2. I am able to do things well as most other people.	1	2	3	4	5
3. I feel I do not have much to be proud of.	1	2	3	4	5
4. At times I think I am no good at all.	1	2	3	4	5
5. On the whole, I am satisfied with myself.	1	2	3	4	5
6. I wish I could have more respect for myself.	1	2	3	4	5
7. All in all, I am inclined to feel I am a failure.	1	2	3	4	5
8. I certainly feel useless at times.	1	2	3	4	5
9. I feel I have a number of good qualities.	1	2	3	4	5
10. I feel that I am a person of worth.	1	2	3	4	5

Next, we are interested in your feelings and attitudes about yourself and the future.

		Strongly agree				Strongly Disagree
1.	I look forward to the future with hope and enthusiasm.	1	2	3	4	5
2.	My future seems dark to me.	1	2	3	4	5
3.	I might as well give up because I can't make things better for myself.	1	2	3	4	5
4.	When things are going badly, I am helped by knowing they can't stay that way forever.	1	2	3	4	5
5.	I have great faith in the future.	1	2	3	4	5
6.	There is no use in really trying to get something I want because I probably won't get it.	1	2	3	4	5
7.	My past experiences have prepared me well for my future.	1	2	3	4	5
8.	I just don't get the breaks, and there is no reason to believe I will in the future.	1	2	3	4	5
9.	When I look ahead to the future, I expect I will be happier than I am now.	1	2	3	4	5
10.	I have made many plans for my future, I expect to get more of the good things in life than the average person.	1	2	3	4	5

Finally, we would like to ask a few questions about yourself for statistical purposes.

1. Your gender. (Circle number of your answer)

   1 MALE
   2 FEMALE

2. Did you serve in the armed services? (circle number)

   1 NO
   2 YES ... Year entered _____
             Year discharged _____

3. What was your approximately net income from all sources, before taxes, prior to entering the armed forces? (Circle number)

   1 LESS THAN $3,000
   2 3,000 TO 4,999
   3 5,000 TO 6,999
   4 7,000 TO 9,999
   5 10,000 TO 12,999
   6 13,000 TO 15,999
   7 16,000 TO 19,999
   8 20,000 TO 24,999
   9 25,000 TO 29,000
   10 OVER $30,000

4. Which is the highest level of education that you completed? (Circle number)

   1 NO FORMAL EDUCATION
   2 SOME GRADE SCHOOL
   3 COMPLETED GRADE SCHOOL
   4 SOME HIGH SCHOOL
   5 COMPLETED HIGH SCHOOL
   6 SOME COLLEGE
   7 COMPLETED COLLEGE (Specify major) _____
   8 SOME GRADUATE WORK (Specify degree) _____

5. What is the highest level of education that your parents have completed?

FATHER	MOTHER	
1	1	NO FORMAL EDUCATION
2	2	SOME GRADE SCHOOL
3	3	COMPLETED GRADE SCHOOL
4	4	SOME HIGH SCHOOL
5	5	COMPLETED HIGH SCHOOL
6	6	SOME COLLEGE
7	7	COMPLETED COLLEGE ———
8	8	SOME GRADUATE WORK
9	9	A GRADUATE DEGREE ———

6. What is your religious preference? (Circle number)

1 PROTESTANT (Specify denomination) ———————
2 JEWISH
3 CATHOLIC
4 OTHER ... (Specify) ———————
5 NONE

7. Are you presently: (Circle number)

1 EMPLOYED...(Specify type of work) ———————
2 UNEMPLOYED
3 RETIRED
4 FULL-TIME HOMEMAKER

8. What is your present age?

——————————— YEARS

9. Which of the following best describes your racial or ethnic identification? (Circle number)

1 BLACK (NEGRO)
2 CHICANO (MEXICAN-AMERICAN)
3 NATIVE AMERICAN (AMERICAN INDIAN)
4 WHITE (CAUCASIAN)
5 ORIENTAL (MONGOLIAN)
6 MALAYAN
7 OTHER -- SPECIFY ———————————

10. What is your current duty station _____

11. Who is your immediate supervisor at this duty station _____ .

Is there anything else you would like to tell us about the Functional Skills Program? If so, please use this space for that purpose. Also, any comments you wish to make that you think may help us to understand the needs of future program participants will be appreciated.

Your contribution to this effort is very greatly appreciated.

VITA

Name: Pedro Antonio Cartagena

Date of Birth: September 27, 1952

Address: 3938 Kiwanis Loop
Virginia Beach, VA 23456

Education:

1969 - Graduated from Baker High School, Columbus, GA.

1976 - Attended University of San Diego, graduating with B. A. in History.

1984 - Received M. Ed. in Educational Administration University of Puerto Rico, Rio Piedras, PR.

1990 - Received Certificate of Advanced Study in Educational Administration Virginia Polytechnic Institute and State University.

1990 - Received Ed.D in Educational Administration at Virginia Polytechnic Institute & State University.

Experience:

1971 - 1990 U.S. Navy - Dental Technician

1985 - 1990 Management Analyst

1990 - 1990 Supply Officer

Professional Association: Member, Knights of Templar
Phi Alpha Theta
Member, Institute of Improvement
Member, VPI Alumni 1872 Society

Pedro A Cartagena

Pedro Antonio Cartagena