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An intervention program for college students diagnosed with dyslexia based on theoretical principles.

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AN INTERVENTION PROGRAM FOR COLLEGE STUDENTS DIAGNOSED WITH

DYSLEXIA BASED ON THEORETICAL PRINCIPLES

A Thesis Presented

by

KENNETH A. RATH

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

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Psychology

AN INTERVENTION PROGRAM FOR COLLEGE STUDENTS DIAGNOSED WITH
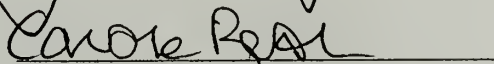
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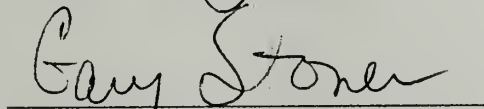A Thesis Presented

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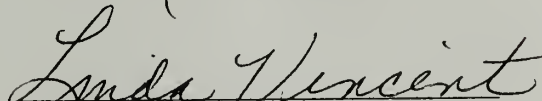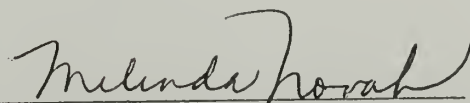Approved as to style and content by:

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ABSTRACT

AN INTERVENTION PROGRAM FOR COLLEGE STUDENTS DIAGNOSED WITH

DYSLEXIA BASED ON THEORETICAL PRINCIPLES

SEPTEMBER 1998

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The research contained within this thesis was conducted
for the purpose of designing an intervention program for
dyslexic college students that would increase their reading
ability.

There is an increasingly large number of dyslexic
students in colleges today as compared to a few years ago,
and most of these students need some form of intervening
assistance in order to perform at capacity. Many
interventions are available in colleges and universities,
but these interventions are all aimed at helping the student
compensate for his or her disability rather than improving
the individual's reading ability. As the literature is
mostly in agreement that dyslexia is primarily caused by a
deficit in phonological processing, it was necessary to
construct an intervention that addressed this issue.

The intervention proposed herein was designed to
improve reading ability by increasing the participants' word

recognition skill on individual words contained in word lists. The theory, based on studies done previously with children, was that the participants would learn to break down words into parts without having to use phonological deconstruction strategies. It was anticipated that performance would thereby increase on the recognition of unpracticed words, nonwords, sentence reading and general reading skill.

Three college students from the University of Massachusetts who expressed reading problems were tested using the Sentence Verification Technique (SVT), the Computer-based Academic Assessment System (CAAS), an inference test and a reading sample, which collected comprehension, accuracy, and response time data. They were then given the intervention, which comprised of reading through word lists composed from materials which the participants were currently studying, and re-tested periodically throughout and at the end of the study.

The results were analyzed to determine if any progress was made on the measures as a result of the intervention. Significant progress was made in naming nonwords and in completing sentences, while there were indications that reading speed and other measures increased as well.

It was concluded that the intervention seemed, in fact, to increase the participants' overall reading ability and

that it would be an effective and cost-efficient aid for
dyslexic college students.

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CHAPTER 1

INTRODUCTION

It is widely accepted that students diagnosed with
dyslexia have a more difficult time in an academic setting,
especially in terms of the written language, than do
nondiagnosed students. As a matter of fact, this is very
nearly the what is meant by the term "dyslexia."

The bulk of research in the field of dyslexia has
concentrated on children and adolescents, while
comparatively little research has been performed with
adults, although this extreme age bias in the literature is
being slowly remedied (Gerber, 1994; Malcolm, Polatajko &
Simons, 1990). Still, in 1990 articles focused on adults
comprised only 12-27% of the major journals of learning
disabilities (Patton & Polloway, 1992). This literature
bias is surprisingly evident even in colleges and
universities, where one might expect there to be a greater
interest than elsewhere in the adult community, what with
the emphasis on research in many of our places of higher
learning.

With the lack of experimentation at the college level
comes a corresponding lack of research into the
effectiveness of interventions that are available to
students diagnosed with dyslexia in order for them to work

with their disabilities and succeed in the postsecondary setting. In this thesis I intend to review the currently available interventions, with as much information included on their effectiveness as possible, and then to review an intervention of my own devising (with much help and support from my colleagues) that I believe addresses the deficits of many of the other interventions.

Before reviewing the interventions, however, it is necessary to understand the state of dyslexically diagnosed students as they enter college, and thus to understand why some form of intervention is necessary.

The College Experiences of Students Diagnosed with Dyslexia

Students diagnosed with dyslexia are less likely than nondisabled students to go to college. White, Alley, Deshler, Schumaker, Warner and Clark (1982) reported that, compared to 84% of nondisabled students, only 67% of high school students diagnosed with some kind of a learning disability (like dyslexia) reported having plans for further education. Scuccimarra and Speece (1990) found that 60% of their sample of high school students diagnosed with learning disabilities did not pursue any form of training after high school. In Fourqurean, Meisgeier, Swank and Williams' study (1991) they found that 26% attend college on a vocational-

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technical school and 35% attended job training or training
through military service. Martin (1996) placed the
percentages at 19.0% attending vocational school, 13.7% a
two-year college and a mere 4.4% attending four-year
colleges. A study by Wagner (1989 as cited in Gregg, 1996)
estimated that only 16.7% of learning disabled-diagnosed
individuals participated in postsecondary education and only
9% in two- or four-year colleges, compared with 50% of
nondisabled students attending postsecondary institutions.
Clearly the selection process is harder on the disabled than
on nondisabled students, which can be attributed to the fact
that they often perform more poorly in school.

Still, the number of students entering college who have
been diagnosed with a form of learning disability has been
increasing. In 1978, 2.6% of college freshmen reported
disabilities while by 1991 8.8% did, with learning
disabilities as the fastest growing type of disability
(Henderson, 1992 as cited in Day & Edwards, 1996). Day and
Edwards (1996) attribute this to several factors. The first
was the passage of Section 504 "E" of the Rehabilitation Act
which made accessibility to postsecondary education for
disabled persons mandatory. This was followed by the
passage of PL 94-142 and PL 101-406 which mandated
elementary and secondary education for learning disabled
children, allowing more to be prepared for college. Now,

many more students have completed the necessary coursework for entering college. In addition, colleges find learning disabled students to be attractive as a viable market for admissions, advocacy groups and guidebooks help to make students more aware of their rights and options, and the increased use of computers and compensatory technology allows more students to succeed independently. Strichart and Mangrum (1985) state as additional reasons that high school programs have been extended into colleges, students have a greater desire to go to college (presumably due to job opportunities) and that colleges are finding it necessary to recruit more students. For these, and probably other, reasons, the number of students in colleges who have been diagnosed with some form of learning disability has increased dramatically over the past two decades.

Research also indicates that students diagnosed as being learning disabled, once they enter college, are less prepared for the experience than are their peers, as discerned by a variety of measures (Brinckerhoff, Shaw & McGuire, 1992; Gregg, 1996; Vogel & Adelman, 1990) and often find it difficult to work at the same level of performance as their peers (Cohen, 1984). This is often attributed to the fact that the initiative is placed into the hands of the student in terms of getting the help that they need, as opposed to the situation in high school, where counselors

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and teachers perform most of the legwork for them
(Brinckerhoff et. al., 1992).

In college, learning disabled-diagnosed students tend
to congregate in fields that place the least burden on their
areas of weakness, which is usually reading and writing
(Johnston, 1984), since a sizable proportion of those are
diagnosed with dyslexia. Wilczenski (1993) found that such
students were found more often in the fine arts, social and
behavioral sciences and physical education and less often in
other fields. Critchley (1973 as cited in Johnston, 1984)
also found a preference for drama, music and dance as
majors.

In order to get help suitable to their difficulties,
students with a learning disabilities diagnosis are
personally responsible for seeking out services and
appropriate testing, a process that often involves a
substantial fee. Because of this a significant number of
these students do not report their problems and go through
their college career unassisted (Levinson, 1986), although
these students are increasingly vocal and visible (Cox &
Klas, 1996). Houck, Asselin, Troutman and Arrington (1992)
cite figures estimating the percentage of college students
having learning disabilities as being somewhere between
three and eleven percent. Astin, Green, Korn, Schalit and
Berg (1988 as cited in Vogel & Adelman, 1992) reported 1% of

all freshmen claiming to have a learning disability, but
Vogel and Adelman (1992) estimated that the number was much
greater due to the exclusion of part-time and transfer
students from the data set. The number of unreported cases
undoubtedly adds further numbers to the total. It is clear,
then, that there is a sizable population requiring services.
These services are often difficult to get (National Joint
Committee on Learning Disabilities, 1985, in Yost et al.,
1994), especially if the student is gifted in other fields
(Stanzel, 1996), and although faculty members are usually
willing to help as best they can, they often don't have the
knowledge to do so effectively (Allard, Dodd & Peralez,
1987; Houck et al., 1992; National Joint Committee on
Learning Disabilities, 1985 in Yost et al., 1994; Norlander,
Shaw & McGuire, 1990).

Even though they self-select into fields that have a
tendency to minimize the effect of their disability on
general school performance and even with the interventions
available to them, learning disabled-diagnosed college
students still do more poorly than their nondisabled peers
(Vogel & Adelman, 1990; Wilczenski & Gillespie-Silver,
1992). Interestingly, however, some studies have found that
they have the same rate of dropping out and academic failure
as nondisabled students (Vogel & Adelman, 1990, 1992;
Wilczenski, 1993). Other studies such as that by Cowles and

Keim (1995), however, found that only 24% of the diagnosed students in their sample graduated compared to 43% in the general student body after six years, and most of those who graduated received special support services.

Students diagnosed as being learning disabled have a variety of problems that cause this lesser performance. They almost always need to spend more time and energy on their studies than their nondisabled peers (Bireley & Manley, 1980), which can be a source of great discouragement. In addition they often have a variety of reading or comprehension problems, unrealistic (usually overly optimistic) views of their abilities, and find themselves unable to discover ways to increase their academic performance (Bireley & Manley, 1980). Strichart and Mangrum (1985) believe that virtually all learning disabled students require some degree of remedial services.

It is therefore the case that we have a sizable population of people in college situations who have learning disabilities, although it must be recognized that this is a far smaller percentage of the total population with disabilities than the percentage of nondisabled people who enter postsecondary education. This population is, in general, less prepared for the college situation than the general student body, and is in need of some form of intervention. In some cases the interventions are

available, but in far too many they are not. A study by McKee (1987 as reported in Cox & Klas, 1996) showed that 10% of Canadian colleges and universities have no learning disabilities services whatsoever, and only 16% have a written policy to deal with the issue. The situation is similar in American schools. As of 1997, only 23 American colleges and universities have internet sites that specifically advertise a program for learning disabled students (LD Resources, 1997). In the late 1980's, many colleges claimed to offer support services for learning disabled students, but in reality merely offer programs that were directed at the entire student body, or offered programs in past years due to the efforts of a single student but no longer did once the student had left (McGuire & Shaw, 1987; Strichart & Mangrum, 1985). More recently, the programs themselves have become less ephemeral, but their quality is highly variable. Because of administrative fiat, changes in funding and changes in the image that the institution is trying to project, programs that were very good one year can become a haphazard mix of services the next (Small, 1996).

For those students who are able to secure an intervention program for themselves, the major issues to take note of are what types of interventions they are receiving and to what extent these programs allow them to

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function in the college environment. One major issue that will be looked at here is the extent to which the interventions attempt to help the students overcome their disabilities rather than circumvent those things that give them difficulty.

Interventions

There are many interventions available in colleges across the country. For the sake of clarity, these interventions have broken down into five major groups, which, although somewhat arbitrary in nature, do illustrate some of the major distinctions between methods. These five groups are assistive technologies (computer programs and the like that are provided to make learning less effortful for the student), program modifications (the use of untimed tests, etc., to balance out the disability), therapy and counseling (helping the student cope with the experiences resulting from the disability) strategy training (the teaching of a variety of skills to help the student work in spite of the disability), and direct assistance (helping the student learn the material directly). Each intervention type is used by various service programs to different degrees. A sixth type of intervention, a "disability attacking" approach, has also been proposed (Guyer &

Sabatino, 1989) in which the problems involved in the disability itself are addressed and an attempt is made to partially overcome them, but this corrective intervention is not in use in any of the current service programs in the United States, as far as the research has stated. It is an intervention of this last type that is proposed for this thesis.

The general opinion, of course, is that no one intervention program works for everyone (including the one I am proposing), and that the interventions must be tailored for the individual (Johnston, 1984; Vogel, 1982).

Many learning disabilities support programs at colleges are a mixture of several types of interventions. An example is that of Landmark College in Putney, Vermont, which is a college designed specifically for dyslexic and other special needs students. On this campus, students receive four and a half hours of direct tutoring per week, counseling services, skills development courses over the summer in a variety of important areas and an individual academic advisor (Landmark College, 1998). This is a top-of-the-line school in terms of providing services, and it demonstrates how several types of interventions can be integrated into one program.

In the pages that follow each of the intervention types mentioned above will be outlined and some details on how

they are used and their effectiveness for the student will
be given.

Assistive Technologies

There are a wide variety of technologies that have been
used with students diagnosed as being learning disabled or,
specifically, as being dyslexic to make their college
experience less of a burden—to put them on more even ground
with their nondisabled peers. In this category are placed
not only those technologies, such as taped texts and
proofreading programs, that assist students in learning, but
also readers and note-takers that serve a similar purpose.
All of the assistive technologies make the job of the
student less difficult, but in doing so take away some of
the skill that would otherwise be needed to successfully
complete their education.

Perhaps the most common of these technologies is the
use of textbooks that have been prerecorded onto a tape, a
method that was used in 69% of the schools surveyed by Yost,
Shaw, Cullen and Bigaj (1994). These tapes can be very
helpful for a student who has difficulty reading as they
significantly decrease the amount of time that needs to be
spent on retrieving material from the text. A major problem
with this method is that many students find it difficult to

pull apart key material from less important information when listening to taped texts (Vogel, 1982). And, of course, there is the problem that the student is not practicing reading the subject material in question, a valuable skill that they would otherwise be acquiring.

Another assistive method for overcoming reading problems is the use of readers, a method that 69% of Yost et al.'s (1994) institutions employed. Readers work much as taped texts do, with a live person substituting for the audio equipment in this case. This allows the student to ask questions and find out which points are most important, but also involves a large time commitment on the part of the readers. Again, in this intervention method there is the inherent problem of not allowing the student to develop reading experience.

Raskind (1993, 1994) gives a list of other assistive technologies that can be and sometimes are used in programs to help students with a variety of learning disability diagnoses. He includes various computer programs, such as word processors with spell checkers, proofreading programs (which are usually not all that good), outlining programs, speech sensitive programs, personal data managers, and databases. He also speculates on a variety of technologies such as optical character recognition systems hooked up to speech synthesizers (for reading textbooks), and variable

speech control tape recorders (to allow the student to slow down lectures and thus glean more information from them). Many of these are readily available at a number of colleges, although not all (Day & Edwards, 1996). Some of these are very useful tools and wouldn't take much away from the learning experience (such as the spell checker, which even nondisabled students often find themselves relying upon), while others are far more elaborate, expensive, and can severely limit the skills the student would otherwise be acquiring.

Recent legislation such as Section 504 "E" of the Rehabilitation Act, the Technology-Related Assistance for Individuals with Disabilities Act, and the Americans with Disabilities Act have made it so that the lack of provision of assistive technologies could result in litigation against the institution (Day & Edwards, 1996). California has started a statewide program for the institutionalized use of such technologies in assisting learning disabled students, and several other colleges are following their lead (Day & Edwards, 1996). Clearly, there is a great deal of interest in such interventions, which, coupled with the stated interest of many postsecondary institutions in advanced technology, makes it quite probable that assistive technologies will become one of the most readily available interventions in the near future.

A major problem with all assistive technologies is that they could encourage students not to develop skills that many feel are an important part of the college experience, skills which they may find they need in the absence of the technology. While reliance on a spell checker in order to spell words properly may not be a big deal when they leave college, most people will find it difficult to acquire personal readers, taped texts, or optical character recognition systems with speech synthesizers once they enter the job market. Although these interventions may be very helpful in allowing students to succeed in the college classroom, allow for independent work without the assistance of human instructors, and may provide success where other methods have failed (Raskind, 1994), once students leave the controlled college environment, they could actually be worse off than they would have been on their own due to a reliance on now unavailable technologies.

Program Modifications

Program modifications are those interventions that change some portion of the course so that it is easier for the disabled student. Generally, these modifications are performed on the tests, probably because these are the only part of the class in which it makes sense to provide the

disabled student with a different environment than the other students in the class, and also because it is where the effect of the disability would most noticeably affect the student's grade.

Perhaps the most common program modification is the use of extended or unlimited time on tests for disabled students. It is more common for the mere reason that it is much easier to implement than other methods (Brinckerhoff, Shaw & McGuire, 1992). It is also the intervention recommended by experts in the field (Vogel, 1982) and has been in use since concern for disabled college students came into the limelight (Working Party on the Needs of the Dyslexic Adult, 1974). Runyan (1991) found that giving dyslexic students extra time on reading comprehension tests brought their scores to a comparable level with their nondisabled peers while before they had scored much lower. Nondisabled students, on the other hand, showed little change in their scores with the extra time. Runyan used this data to support the view that extended time evens up the playing field and gives the disabled student an even chance at succeeding in the class. A similar study (Hill, 1984 as cited in Runyan, 1991) found that extended time on the ACT also evened up the score differences between disabled and nondisabled students. There are still controversial issues, however, about the fairness of

allowing one group of students unlimited time while the others have a time limit, and if one tries to correct the problem by giving a limited time extension, one can never truly be confident that the appropriate amount of extra time was supplied to the individual based on his or her abilities.

Allard, Dodd and Peralez (1987) also recommend the use of individually proctored exams. In this circumstance the disabled student would take the exam alone with a proctor, thus minimizing the distractions. Except that individual proctors may be in short supply, this is a feasible and undeniably fair method of intervention, but the extent to which this would actually help the disabled student achieve his or her optimal performance, especially in the absence of other test modifications, is unclear.

Other test modifications modify the format of the test taken by the disabled student as compared to the rest of the class. Vogel and Sattler (1981, in Vogel, 1982) recommend the use of essays as opposed to objective exams and using other methods besides testing to gage students' performance. Allard, Dodd and Peralez (1987) also recommend the use of oral or taped exams and accepting taped rather than written answers. In some cases, such test modifications may even be required by law (Brinckerhoff, Shaw & McGuire, 1992).

There are two major problems with the test format modification method of intervention, however. The first is that it is often very difficult to make a test using a different format that measures the same thing as the general test, and these specialized test methods are much harder to grade than standard tests, so it would be unreasonable for all of the students to hand in tests in which the answers have been taped, or even as essays, if the class were large. The second problem is that when a second exam form is made one can never be sure that scores on the second exam will compare accurately to scores on the first without extensive reliability testing. Not surprisingly, few professors have the time or ability to perform such analyses on the second forms of their tests before handing them out. Because of this, test form modifications may end up being quite unfair, to either disabled or nondisabled students, a sticky problem indeed.

A final program modification, one that does not involve the changing of tests, is the changing of the program itself. Allard, Dodd and Peralez (1987) recommend allowing disabled student more time (in semesters) to complete the necessary coursework than would normally be allowed. This allows them to spend more time on each individual course, time which their disability makes necessary. I think that this is an entirely reasonable accommodation, and does

nothing to compromise the quality of the student's education.

Another modification of the student's program involves the waiver of certain courses that would normally be required in order to complete the degree. This generally means waiving foreign language requirements for dyslexic students and math requirements for those with math disabilities. Yost et al. (1994) found that a minority of college personnel, 19% for the foreign language waiver and 15% for the math, agreed with this policy. Yet the courses are still waived in some cases. The problems with this intervention are potentially severe. In these cases the students are often not learning as much as their peers in the program, and they are not learning some things because they are deemed to highlight the student's disability (Learning Disabilities Support Services, 1997). This not only doesn't try to help students overcome their disabilities, it may even encourage them not to.

A more modern variant of the course waiver mentioned above is course substitution. In this case, colleges substitute a traditionally required course with another of (presumably) equal value but more in line with the student's abilities (Learning Disabilities Support Services, 1997). This may have the same problems as a course waiver if the substitute course does not cover the material that was

traditionally required, but if the substitute course covers information of equal importance to the student but is tailored to his or her learning needs the overall quality of education is hardly effected.

Therapy and Counseling

Many colleges offer psychological support in one form or another to students with learning disabilities in an attempt to help them deal with their disability and the feelings of helplessness and frustration that accompany it. In general, students cope with their disability by either becoming strongly academically oriented and independent or by becoming depressed and dependent on the help of others (Lefebvre, 1984). Students in the second category often have personality and social problems, low motivation, low ego and are hypersensitive (Lutwak & Fine, 1983). It is this group of students, especially, that often needs therapeutic assistance.

Therapy generally involves having the students talk individually with a professional therapist about their daily experiences (Haufrecht & Berger, 1984; Kroll, 1984). The professional's job is to listen, to help them deal with failure (Johnston, 1984) and build self-esteem. In some cases there may be a neuropsychological aspect to the

therapy as well (Kemp, 1992), allowing the therapist to explain the underlying basis for the disability and help the student understand it. In other cases the therapist attempts to help the student overcome anxiety associated with coursework through relaxation techniques (Decker, Polloway & Decker, 1985; Haufrecht & Berger, 1984), although this does not necessarily improve academic performance (Decker et al., 1985) as other issues aside from anxiety are often present. Sometimes, the therapy has to deal with other behavioral problems that may stem from the disability (although the connection is often hard to find) such as reckless and uncontrolled behavior (Wren, Williams & Kovitz, 1987).

Another way in which colleges provide therapy is through the formation of peer-support groups (Allard et al., 1987; Kroll, 1984). These support groups are excellent sources for providing a feeling of acceptance and can help in developing autonomy, integrity and a good self identity (Orzek, 1984). They also serve to improve self esteem (Kroll, 1984; McWhirter & McWhirter, 1990). They are often run by a trained professional who structures the discussion and provides topics (Orzek, 1984). Support groups can also help improve social skills, which are often considered to be weak in many disabled students (Vogel, 1982).

In general, therapy and support groups do not directly address the issue of the academic difficulties caused by a learning disability, and as the sole method of intervention they may not be all that effective. They can, however, help the student deal with a wide variety of psychological issues that stem from having a disability. These issues may, at times, severely hamper their learning in relation to their peers. In addition, issues related to stress from other sources may affect them more severely than their nondisabled peers. These psychological issues can adversely effect performance themselves (Allard, Dodd & Peralez, 1992) and cause the decay of compensation skills (Meintz, 1993). Addressing them can be very valuable and effective in helping the student overcome the learning disabilities themselves.

Therapists must be very careful not to engage in countertherapeutic styles, such as inadvertently limiting the student's options, fostering false autonomy, negative dependency, etc., as described in Lutwak and Fine (1983), which requires that they be extensively trained in working with learning disabled students. Unfortunately, counselors may not have the necessary training, making the therapy counterproductive (Lutwak & Fine, 1983). Properly conducted therapy, however, has been shown to help students with

emotional and social problems that would otherwise have hampered their college performance (Barbaro, 1982).

Counseling is another often-used intervention. A counselor provides the student with direction in terms of his or her college decisions and future goals (Vogel, 1982). Although the terms "counseling" and "therapy" are often used interchangeably in the literature, there is a functional difference between the counselor who deals with academic and job-related issues and the therapist who deals with emotional and experiential issues, which is why they are treated separately here, even though the roles can easily be combined into the same person.

The counselors are often instrumental in helping the student create a course schedule, attempting to find the optimal course difficulty to allow the student to succeed (Bireley & Manley, 1980). Counseling sessions are often used to reduce anxiety over the perceived threat present in the academic environment, collect data as to the effectiveness of the services being provided by the institution and assess the students' needs (Bireley & Manley, 1980). In some cases, the counselor is a peer assigned to look after the student, which Allard et al. (1987) term a mentor. The counselor is also often responsible for contacting the professors and setting up the

necessary interventions at that level as well (Sullivan,
Nicolellis, Danley & MacDonald-Wilson, 1993).

Counseling, again, is not (in most cases) an
intervention that will allow students to succeed with a
disability in the absence of other assistance if the
students would not otherwise have succeeded. But the
counselor can be very helpful in preparing students for the
future and in helping them make intelligent decisions on
coursework that take their limitations into account.

Strategy Training

Many learning disabled students have problems with a
variety of skills that, although not directly stemming from
their disability (although it will later be shown that such
problems are related to the deficit that underlies the
disability, at least in the case of dyslexia), certainly
affect their academic performance. An example of such is
the presence of poor organizational skills (Wren et al.,
1987). The general opinion is that many learning disabled
students need considerable academic, personal and study
skill support (McWhirter & McWhirter, 1990). In fact, there
is a school of thought that identifies many learning
disabled people as being specifically strategy deficient
(Deshler, Schumaker, Lenz & Ellis, 1984; Swanson, 1990).

These are the problems that strategy training tries to overcome, so that students will be able to succeed in the college setting despite their disabilities.

Some form of strategy training is a common feature of most college intervention programs. It involves training the student in a variety of skill areas which should allow them to perform better in their classes. The goal of the training is to allow the student to approach a problem and select an appropriate strategy that allows it to be solved (Borkowski, 1992; Butler, 1995; Ellis, 1993; Montague, 1993). Skills that are the target of training may be academic, social, emotional and self-help strategies, all of which can be a problem for learning disabled students (Hildreth, Dixon, Frerichs & Heflin, 1994). Emotional strategies generally fall under the domain of the school counselor, and are more appropriately covered in that section.

Strategy training has been shown to have long-lasting effects (Brinckerhoff et al., 1992; Swanson, 1990), especially if the staff involved are well-trained (Westberry, 1994). The training works best if the student is not told what to do but, rather, is guided into developing the strategies themselves (Butler, 1995) or to explore a variety of strategies provided by the instructor (Borkowski, 1992), which makes it more likely that the

strategies will be able to be generalized for use in a variety of situations. Self-directed strategy learning also gives students tools that are more in line with their own cognitive processes, as opposed to being taught strategies that were designed for someone else's mode of thinking (Borkowski, 1992; Butler, 1995). Unfortunately, much training still teaches specific strategies without any thought for how the strategy fits in with the student's individualized cognitive processes, thus making the strategy useless to the student in a real-life setting.

Decker et al. (1985) also recommend strategy training as a way to decrease students' anxiety, especially the training of study skills. The idea is that once students have tools which they can use that will help them learn more effectively they will be more confident in themselves. In addition, effective strategy use can increase a student's self-esteem, with all the benefits associated therein (Groteluschen, Borkowski & Hale, 1990).

Strategy training can be provided for almost every aspect of a student's academic life that could give difficulty if the student lacks the proper strategies. In Yost et al.'s (1994) survey, they found that 86% of the colleges surveyed taught organizational skills, 84% test-taking strategies, 83% time management skills, 81% study skills, 79% communication skills, 76% memory strategies, 74%

note-taking skills, 69% listening skills, 64% social skills and 52% metacognitive skills. In addition to this list, Vogel (1982) also discusses the use of writing strategies. In some cases the training is provided individually, while in others it is in the context of an additional college course (McWhirter & McWhirter, 1990).

An example of how such strategy teaching works can be seen with memory strategy training. Memory trainers will often spend a lot of effort on teaching elaborative investigation, in which the student develops rational explanations for the information being studied, and the use of mnemonics. Both techniques used in tandem have been shown to greatly increase a student's memory performance (Scruggs, Mastropieri, Sullivan & Hesser, 1993). Generally, the mnemonics used are discovered by the student rather than presented by the trainer (Haufrecht & Berger, 1984), as are the elaborative investigations.

Another related intervention is the training of self-advocacy, which was an intervention used by 87% of the institutions in Yost et al.'s (1994) survey. This form of training concentrates on raising students' awareness of their learning disabilities and the limitations involved therein and developing their ability to convey this information to their professors so that they can get the assistance they need (Roffman, Herzog & Wershba-Gershon,

1994). This form of training expands students' self knowledge and allows the use of this knowledge in a social context (Roffman et al., 1994). It is especially important to have self-advocacy skills when students have to deal with professors who are skeptical about the existence of learning disabilities (McWhirter & McWhirter, 1990). It is also a great step in the direction of promoting independence instead of reliance on the help of others in dealing with the disability (Brinckerhoff et al., 1992).

Oftentimes, these interventions are very useful, especially when they involve a large amount of input from the students in the production of strategies, and they can do a great deal towards helping students meet their academic potential. If taught correctly, which involves encouraging students to think and develop strategies for themselves, these interventions can go a long way toward promoting independence from services provided by the institution. This training should last a lifetime (Brinckerhoff et al., 1992; Groteluschen et al., 1990).

It is important to realize that, even though the strategies may be used, the performance of disabled students might not be up to the level of their nondisabled peers and that strategies that are taught might not necessarily "stick" with the student as intended (Montague, 1993; Swanson, 1990). Transfer and encoding of strategy use are

sticky issues, and it is very difficult for the instructor
to be assured of success in these goals (Swanson, 1990).
Strategy training is very useful, but it does not fix
everything.

These approaches teach compensatory strategies and do
not get at the root of the problem, which is generally a
tremendous difficulty in reading. Training in strategies is
very useful, but if it could be combined with some method of
addressing the reading problem, the intervention would
undoubtedly be much more effective.

Direct Assistance

Direct assistance interventions are generally given in
one of two forms: tutoring and remediation. Both methods
are aimed at helping students learn material that is
specific for the course or courses that are being taught.

Tutoring is a part of 89% of the intervention programs
surveyed by Yost et al. (1994), the most commonly used of
any method, and is recommended by several researchers
(Allard et al., 1987; Vogel, 1982). It generally involves
direct, one-on-one assistance from a professional or (more
commonly) an upper-level undergraduate or graduate student
in a particular course (Bireley & Manley, 1980). The
biggest problem with tutoring is that it has a tendency to

foster reliance on the tutor for learning the material (Deshler, Schumaker, Lenz & Ellis, 1984) and has been shown to have few long-term benefits (Brinckerhoff et al., 1992). Many students see their tutors as their key to success in college, and are unwilling to let go of their assistance (Barbaro, 1982). In summary, the general opinion of the researchers in the field (as cited above) is that tutoring is a support, and when the college student graduates, the support is gone. This is not to say that tutoring is bad in all instances, but in the absence of any other form of help (such as strategy training) it can serve to hurt students by leaving them unprepared to learn on their own.

Yost et al. (1994) reported that remediation was used as an intervention in 71% of their sample of colleges. Remediation courses are more readily available at community colleges where the proportion of learning disabled students is higher due to lower admissions criteria (Mellard, 1994) and may be quite rare at more competitive institutions. Remediation involves the creation of a separate class—usually a small group or sometimes just the individual student and the instructor—with a parallel curriculum that has been specially designed for the students who need extra help and time in the particular subject area (Vogel, 1982). When students are highly motivated, they can make dramatic gains through remediation (Vogel, 1982). The cost of this

intervention is, however, extremely expensive per student, and may be beyond the means of the college or student (depending on who is paying). The plus side is that as skills improve the need for course support diminishes and the student becomes more independent (Vogel, 1982). In this respect remediation is superior to tutoring.

There is some concern, however, that remedial services could threaten the overall quality of education at colleges where they are provided (Cox & Klas, 1996), especially if the remedial courses "water down" the curriculum. This is an important concern, and has to be weighed carefully against the benefits incurred from the instruction. Another concern (Deshler et al., 1984) is that the remediation may still not be sufficient to allow the student to cope with the curriculum, especially if the courses are not "watered down". It is usually still worth the try, however.

Direct assistance interventions serve to improve students' performance in the subject matter in question and can be very helpful in getting a learning disabled student through college (Vogel, 1982). On the other hand, they are either very expensive (in the case of remediation) or dependence causing (as in tutoring) or both. And, generally, they do not address the primary difficulty of dyslexic students, namely reading.

"Disability Attacking" Interventions

This category has been used to describe interventions that attempt to "attack" the source of students' disabilities—which, in the case of individuals who have been identified as dyslexics, is their lack of ability to read at a level that is commensurate with their peers. This would seem to be the most logical thing to do in order to help a student overcome the reading disability—attack the problem itself. Yet in Yost et al.'s survey (1994) no colleges used intervention methods of this type, and in the literature I have been able to find only one example of such a method, and only a study (as opposed to an intervention actually used in an academic setting) at that. This is the use of the Orton-Gillingham phonetic-based instructional approach as described in Guyer and Sabatino (1989). As to why there is such a paucity of "disability attacking" interventions, I would conjecture that there has been a literature-wide lack of successful methods that attempt to improve the individual's actual reading ability, thus giving colleges little to nothing to go on, with the above-stated study as the single exception. Another factor that may contribute to this paucity is that many colleges (especially four-year colleges and universities) do not see it as their mission to

remediate students or directly address their learning difficulties (Linda Vincent, personal communication).

The Orton-Gillingham approach is a multisensory phonetic approach to reading instruction which uses alphabetic synthesis (Gillingham & Orton, 1933; Gillingham & Stillman, 1969). It focuses on fusing small units, such as letters, sounds, syllables and accents, into words, with emphasis placed on reducing the language to its basic elements. Stimulus materials such as those found in Steere, Peck and Kahn (1968) were used for the study. These materials teach the student a variety of skills designed to illuminate the rules used to deal with the division, accent and pronunciation of syllables and the rules of proper spelling methods. Generally, they are in the form of a brief explanation of the rule in question followed by a few examples and then problems in the same vein that the student should solve. Guyer and Sabatino (1989) found that the technique allowed college students to make more progress in reading than when a nonphonetic approach was used or when no intervention was given.

The basic theory behind this approach is that a phonetically-based instruction method, which is basically a bottom-up process (i.e. it starts with the small building blocks of reading and works its way toward larger parts) will be able to help at least some dyslexics overcome their

reading problems (at least to a certain degree) at the college level. The approach is based on a general theory of dyslexia as an orthographic problem wherein letters are processed incorrectly or in the wrong order (Gillingham & Orton, 1933; Gillingham & Stillman, 1969), with the idea that drilling students as to the proper representations of words and syllables will allow them to build up an internal representation of the way such things should be. In its original form, the method even went so far as to begin with kinesthetic exercises to teach the child the proper forms of letters. It has evolved much since those early days.

Although the phonetic basis of this strategy is, to some degree, sound, I contend that the research suggests that only modest success can be achieved by using such methods. In its stead, I have proposed an intervention based on principles that are more in line with how I see the newest research leaning. This method is also bottom-up, in a sense, but attacks the problem at the word level, with the assumption that the student will begin to break up words themselves. But more will be said about that later.

A Description of the Problem

For some time, researchers have known that many people who have been diagnosed as dyslexics have great difficulty in decoding words when they are reading. Early researchers such as Gillingham and Orton (1933) were under the general impression that this was caused by a problem with orthographic representations—dyslexics were thought to misread letters, reversing them and switching their orientation. This perception has stayed with us in popular culture, and when many lay-persons think of dyslexia they conjure up images of wholesale reversals of "b"s and "d"s (or perhaps even "p"s), turning "cat" into "act" and more complex words into a whole mess of discombobulated letter strings. In fact, there is some evidence of people diagnosed as dyslexics who have orthographic problems such as these (Manis, Szeszulski, Holt, & Graves, 1988; Stanovich, 1988a, 1988b), although these people appear to be in the minority of cases. In general, although diagnosed dyslexics do make a large number of reversal errors, which led to the conclusion that the problem was visually based, the proportion of such errors to the total number of errors is approximately equal to that in the general population

(see Stanovich, 1982, for a review). Generally, those identified as dyslexics don't show any differences from normal readers in terms of visual abilities (Curtis, 1980). The evidence, presented and accepted by a wide range of researchers, points to the culprit, in the vast majority of cases, as being a deficit in phonological processing (as a sampling, see Bruck, 1988, 1990, 1992; Ellis & Large, 1987; Kochnower, Richardson & DiBenedetto, 1983; Lyon, 1996; McBride-Chang, 1995; Pennington, Van Orden, Smith, Green & Haith, 1990; Olson, White, Conners & Rack, 1990; Rack & Olson, 1993; Royer, 1997; Shaywitz & Shaywitz, 1996; Stanovich, 1982, 1988a, 1988b, 1993, 1994; Vogel & Adelman, 1990; or see Stanovich, 1986, for a review). There is other evidence that the deficit may be in the area of verbal short term memory, but Stanovich (1982) has shown that this deficit may be due to the underlying phonological problem, as knowledge of phonetic codes aids short term memory. Phonetic representations in memory appear to be more efficient than other types of representations.

First of all, it is important to describe what it means to have a phonological deficit. Perhaps the clearest way to explain this is to describe the difficulties that phonologically-deficient dyslexics have, and then describe the theories that are used to explain this behavior.

Various research has shown that individuals identified as having dyslexia perform more poorly than non-dyslexics at a variety of reading tasks, even when the two groups are paired for reading comprehension. Perhaps the most salient of these (mainly because the difference in performance is greatest) is the deficit found in the reproduction and naming of pseudowords (or "nonwords") in terms of both accuracy and response time (among many others, see Apthorp, 1995; Bruck, 1988, 1993; Cisero, Royer, Marchant & Jackson, 1997; Compton & Carlisle, 1994; Ellis & Large, 1987; Manis et al., 1988; Olson et al., 1990; Royer, 1997; Royer & Sinatra, 1994; Stanovich, 1986; Stanovich & Siegel, 1994). These are strings of letters which can be sounded out but are not actually words—"orink", for example. It is not much of a stretch to say that these words should be processed in a similar fashion to how unfamiliar words would be, for neither one would be available in the person's lexical repertoire, and therefore both must be processed as novel items. Difficulties in pseudoword processing would, therefore, also be present in general reading when encountering unfamiliar words.

In addition, comprehension-matched dyslexic-diagnosed individuals show poorer word recognition skills than their peers, especially in terms of speed (Bruck, 1990; Cisero et al., 1997; Compton & Carlisle, 1994; Olson et al., 1990;

Royer, 1997; Royer & Sinatra, 1994; Stanovich, 1988a), although the discrepancy is not as strong as it is with nonwords (Cisero et al., 1997; Sinatra, 1989; Stanovich, 1982; or see Olson et al., 1990, for a review). Diagnosed individuals do somewhat better (relative to their nondisabled peers) when the words are in context, and on some words the differences are not noticeable, but in general they are still very slow (Bruck, 1990; Compton & Carlisle, 1994).

It is thought that this difficulty, which appears at the level of word decoding, is the root of the reading difficulties experienced by most of the diagnosed population, and all other comprehension problems stem from the speed and accuracy problems at this level. Stanovich (1980) has concluded that reading speed is strongly dependent on the speed of word recognition, which is sensible, as each word (or nearly every word) in a sentence needs to be recognized before meaning can be gleaned. If more time is needed to recognize individual words, reading speed will correspondingly decrease. To my knowledge, there is no serious debate over this issue. Greene and Royer (1994) found that poor readers, who have word recognition problems in relation to their peers, are significantly below their peers in sentence processing ability, especially in terms of speed.

The question, then, is what does this speed discrepancy do to comprehension? Certainly, dyslexics need additional time in order to read anything, since reading each individual word is more time consuming than among nondisabled readers, but there is also evidence that reading comprehension is affected. Royer (1997) has demonstrated that word recognition performance is, in fact, a good predictor of reading comprehension by grade 4, indicating a relationship between poor word recognition speed and comprehension abilities, a finding supported by Sinatra and Royer (1993). Other researchers, such as Stanovich (1986, 1988b, 1994), have made claims that agree with this.

The explanation for this stems from the idea that the human mind has a limited capacity for processing (Royer, 1997; Sinatra & Royer, 1993; or see Swanson, 1994, for a review), and a finite amount of stuff can be held within the working part of the brain before it has to get rid of some of it in order to make room for new information. The store wherein this processing takes place is often given the general name of "Working Memory" by theoreticians such as Anderson (1993), and is considered to be that part of one's memory (which includes memories stored in Long Term Memory and information that is available at the moment from the environment) which is being actively processed at any given time. Since there is a limit to the amount of things that

can be going on inside of Working Memory at any given time, if it takes more processing effort to recognize individual words there will be less "room" available for comprehension (Blachman, 1996; Curtis, 1980; Royer & Sinatra, 1994; Sinatra & Royer, 1993; Stanovich, 1980, 1990). Swanson (1994) has found that Working Memory is, indeed, a strong predictor of academic success and that dyslexically-diagnosed students perform much more poorly on tasks that involve verbally-based working memory than do their peers. He theorized that the discrepancies found could be due to differences in how the memory was used rather than to capacity differences. If more "room" is being taken up in dyslexics for processes that are relatively "space-free" in non-dyslexics, this performance difference is easily explained.

Taking the inverse of this argument, one would predict that, if the word recognition processes could be freed up, the dyslexic's reading comprehension processes would no longer be hampered, and reading comprehension would be pushed to the level that would be predicted by the student's listening comprehension. This is assumed from the very definition of dyslexia, which is generally seen as a discrepancy between actual reading performance and what would be expected from the student's general level of intellectual functioning. Since individuals who have been

diagnosed with dyslexia are, in general, not hampered by non-reading related deficits, it is reasonable to assume that once the source of reading problems was taken away, a normal level of comprehension would follow (Stanovich, 1988a; Stanovich & Siegel, 1994).

As evidence to support this position, Curtis (1980) found that, as they became older, reading comprehension among good readers became more closely related to listening comprehension and less reliant on word recognition speed, presumably because word processing was no longer effortful and limiting. In less-skilled readers, however, she found the reverse to be true—apparently word recognition was still a problem that hampered these readers. A Study by Cunningham, Stanovich and Wilson (1990) also found that decoding skill was the major predictor of reading comprehension in less-skilled readers while listening comprehension was the major predictor for better readers. The evidence that reading comprehension consists of listening comprehension and decoding components is well supported.

But why would word recognition take up more processing time in dyslexics than in non-dyslexics? Or, in another way of saying the same thing, why is word recognition more effortful for dyslexics? The answer to this question very probably lies in the idea of the encapsulation (a.k.a.

"modularization") of words, as put forth by several researchers (Bruck, 1988, 1990, 1993; Greene & Royer, 1994; Perfetti, 1992; Perfetti, 1988, as cited in Stanovich, 1988a; Royer, 1997; Royer & Sinatra, 1994; Stanovich, 1986, 1990; or see Royer, 1990, for a review). This theory holds that as reading develops, the reader becomes more familiar with individual words and the recognition of these words becomes an "automatic process", in the sense that, whether we want it to be or not, the word will be recognized. This is performed by the mapping of alphabetic, orthogonal elements onto the phonology and meaning, so that once the word is recognized visually the sound associated with it and the meaning are called up automatically, without any conscious processing or searching. Encapsulation occurs for individual words, and unknown words must be decoded using effortful processes until they too become encapsulated. The process of accessing encapsulated information is thought to be a great deal faster than the process of actively trying to process a word based on phonology, context, etc., and, although evidence has shown that encapsulated processing is not free of effort (Perfetti, 1992; Stanovich, 1990), it is thought to make fewer demands on cognitive processing than active methods do. Less processing effort frees up working memory for use on other processes, such as comprehension.

It holds, then, that for some reason dyslexics are either not able to encapsulate words at all or are not as efficient at it as nondisabled readers are. Recall what was said earlier in regards to nonword and word naming among dyslexics. In addition, dyslexics perform badly on a wide variety of other phonologically-related tasks, such as making reports of sound segments, use of codes, categorical perception of phonemes and speech production (Stanovich & Siegel, 1994). Clearly, dyslexics are lacking in the realm of phonological processing, which is directly related to the knowledge of the relationships between the spelling and sound of words (Apthorp, 1995; Bruck, 1988, 1990, 1992, 1993; McBride-Chang, 1995; Stanovich, 1986). The lack of phonological knowledge manifests itself when reading and spelling, but is not the same as the knowledge of sounds needed in order to understand conversation (Pennington et al., 1990). It is because the phonological deficit is only present in reading that the problem is diagnosed as dyslexia rather than some other, perhaps more generalized, problem. This lack of phonological awareness has been shown to continue into adulthood—it is not a disability that one grows out of (Bruck 1992, 1993).

The inability to establish a relationship between spellings and sounds makes it extremely difficult for a dyslexic to encapsulate words, mainly because they have

extreme difficulty in connecting the phonology of the word to its orthographic structure (Royer & Sinatra, 1994; Stanovich, 1994). Bruck (1988, 1990, 1993) has found that, since word recognition is never encapsulated, those diagnosed as dyslexics continue to rely on their limited sight to sound mapping capabilities to decode words, even into adulthood. In addition, they make use of other decoding cues, such as context (Bruck, 1988, 1990; or for a review see Stanovich, 1980, 1986) and orthographic cues (for a review see Stanovich, 1980), much more than nondisabled readers. These are all slow-acting, heavily resource-consuming processes (Stanovich, 1980) and some, like context, can only be used when there is sufficient word knowledge to understand the surrounding text (Stanovich, 1986), which can result in serious disadvantages.

As soon as they start reading, dyslexics do not develop the encapsulation of words that their peers do, and reading quickly becomes a labored process in comparison to their fellows (Blachman, 1996; Bruck, 1993; Stanovich, 1990, 1986, 1993). As they advance in their role as readers, books become harder and they are not able to keep up in terms of their reading ability. Therefore they begin to fall farther and farther behind their peers (see Stanovich, 1986, 1988b, for a review). These phenomena are known as Matthew effects after the passage in the Gospel of Matthew: "For to everyone

who has, more will be given and he will grow rich; but from
the one who has not, even what he has will be taken away"
(Matthew 25:29, The New American Bible With Revised New
Testament, 1988).

Stanovich (1994) sums up the previous ideas and gives a
clear picture of the consequences of these Matthew Effects,
a reduced form of which I have included here. As children
with phonological deficits begin reading, they have trouble
acquiring skills that allow them to decode alphabetic sounds
and thus have difficulty recognizing words, which inhibits
comprehension due to a lack of available resources. The
experiences of attempting to read with these problems are
very unrewarding, and the dyslexic begins to avoid reading,
thus falling farther behind and farther delaying the process
of encapsulating words. As this continues, the student
falls farther and farther behind, and the disadvantages
become greater and greater. Negative emotional side effects
also begin to be associated with academic experience, which
makes things even worse. (For a more detailed description,
see Stanovich, 1986.)

In another article, Stanovich (1988b) examined the
myriad of deficiencies that have come to be associated with
dyslexia, such as a deficiency in strategic abilities, and
found that most of these can be linked to the specific
reading difficulties that dyslexics face. Reading is the

guiding force behind the development of a variety of cognitive skills, vocabulary knowledge and usage, for example, and a deficiency in reading can spill over into these other areas. In addition, he implicates the learned-helplessness and low self-esteem associated with a lack of ability in causing other academically-related deficiencies as well.

What Can Be Done About It?

As demonstrated previously, all of the interventions available for college students diagnosed as being dyslexic are designed to help the students deal with disabilities, either through support services (as in therapy), compensation (as with assistive technologies), extra training (as with strategy training, remediation and tutoring), or bypassing the problem all together (as in extra test time and modified test formats). None of these interventions, however, is focused on what I see as the true root of the problem: the lack of ability on the part of the dyslexically-diagnosed individual to encode words in such a way that they become encapsulated and can be identified quickly enough to make reading efficient and make comprehension possible at a nondisabled level.

A solution that may seem obvious would be to train these individuals in the skills that reflect phonological processing: recognizing letters, attaching sounds to them, building up to syllables, etc. This, basically, was the approach taken by Guyer and Sabatino (1989), with modest but positive results. This, in fact, is the approach that is taken in special education programs across the country. Yet there are still many students diagnosed with dyslexia who make it to the college level without overcoming their disabilities.

In fact, many special education teachers are convinced that these phonics-based approaches don't have much of an effect at all on the reading ability of the students who take part in them (Kochnower et al., 1983). Reading researchers agree that, after a certain age, such approaches have little effect for many individuals diagnosed as dyslexics (Royer, 1997). To many, this may be a surprising finding. After all, many studies do show that some progress is made in phonological knowledge through phonological teaching (O'Connor, Jenkins, Leicester & Slocum, 1993). Some sense can be made out of it, however, by looking at the results of O'Connor et al.'s study (1993) involving very young children. In the study they taught the children one of three different phonological techniques—blending, segmenting and rhyming. They found that the children were

able to learn the technique with some proficiency, but, most importantly for this paper, the children were not able to transfer the phonological abilities that they had learned to other phonological tasks.

This makes sense if one accepts Perfetti's (1992) theory of "computational" and "reflective" phonological knowledge. In brief, computational knowledge involves the simple connections between spelling units and their sounds. Computational knowledge is not conscious—it is more like the inner functioning of the brain on a preconscious level, much like the encapsulation of knowledge described earlier. In the consciousness of the individual, the word seen on the paper is transformed into a word spoken by the "voice in the head", with no conscious processing of the steps that it takes to get there. Reflective knowledge is the awareness of the basic nature of these connections between orthography and phonology. Using reflective knowledge to decode a word involves conscious processing and strategy use. To pull this idea into the field of training dyslexics, phonics training is akin to building up reflective knowledge, but the corresponding computational knowledge does not necessarily become incorporated into the system at an encapsulated level.

This is undeniably a horribly discouraging finding. What is one to do? Is one stuck trying to somehow bypass

the disability without ever being able to address the problem directly?

A Potential Solution

The General Idea

The problem is this: we would like to address the underlying phonological deficits of college students with a diagnosis of dyslexia, but the evidence suggests that doing so through normal phonics-type instruction would be ineffective since these students don't seem to be able to transfer the skills gleaned from such training very readily. After all, many of them have already had years of such training with little effect.

The solution to this problem would have to result in a process that promotes the encapsulation of words *without the use of strategies relying on reflective phonological ability*. And the best way, perhaps the only way, to encapsulate words without having the student use reflective phonetic decoding strategies is memorization. The student can be trained to see the word and, upon hearing the word spoken correctly, associate that sound with the word that he or she sees on the page. Eventually, the word will be

memorized, and the student will be able to call its sound up automatically in association with seeing it on paper.

The obvious criticism of an approach like this is that it really wouldn't help reading in general at all. Sure, students would become better at reading whatever words are being given to them to memorize for that particular session, and there are undeniable benefits to that, but what about unfamiliar words? Aren't these words the real problem anyway?

What if, on the other hand, through beginning to associate sounds with words they also begin to associate sounds with parts of words? If this method does begin to get the dyslexic to associate bits of words to their sound parts, they may be able to transfer these bits to other words that they have not seen before, *without having to use phonetic decoding strategies* to break down the new words. If, for example, the dyslexic student were to memorize the words "plight" and "bled", he or she might be able to break up the sounds of these words in his or her head such that "blight" can be recognized as an amalgamation of the words that were memorized. It thus could be sounded out rapidly, without the tortuous process of phonetic decomposition.

As it turns out, there is evidence that this intervention does work as I have suggested above, at least for children in elementary, middle and high school.

The method used was developed by James M. Royer and his associates at LATAS (the Laboratory for the Assessment and Training of Academic Skills) at the University of Massachusetts in Amherst, of which I am a member. The intervention is described in detail in other sources (Royer, 1997; Royer, Souwaine, Tronsky, Rath & Pajer, 1996; Rath, Tronsky & Royer, 1998), but an overview of the points that are important to this discussion will be given here.

The intervention that LATAS has developed involves providing the children, both those who have been diagnosed with dyslexia and those who have not, with pages of level-appropriate words which they are to memorize at home. They are timed by their parents, and their goal is to reach a time asymptote, whereupon they are moved to the next list of words in the series. Needless to say, the children always become faster at reading the words on the lists, and their time is graphed as an extra incentive (watching the time drop is a motivator for many children).

The intervention program lasts for several weeks (the time which the children stay with the program is determined

by the parents, the children and our recommendations based on their progress), and every week they come into the laboratory to have their progress assessed. On the fourth week of the intervention, and every four weeks after it, the children are tested on tasks that involve words and nonwords that they have not been practicing on their own or seen on the regular assessment dates. They are also tested on a concept and a sentence completion test.

Some improvement in performance is expected at first due to familiarity effects, but these effects should asymptote quickly due to the weekly assessments. In addition, normative data has been collected from a local school, allowing us to test their performance relative to their level of schooling, so maturation effects can be accounted for. Also, the tasks involved have a random sampling from a large number of potential items, so the chances of performance being significantly affected by memory for previous test items (from four weeks previous) is minimal.

Because of these safeguards, the belief is that any substantial increase in performance should provide evidence that the children are, in fact, improving on performance in the relevant skill area. And substantial increases in performance have been found, relative to the current grade level at the time of performance, over time, using the LATAS

intervention (Royer, 1997; Royer et al., 1996; Rath et al., in preparation).

A sampling of such data is found on Figure 1. This presents the gains that have been made by the 17 children, who have been diagnosed as being dyslexic, that have come to LATAS for intervention at an elementary level and who were sufficiently advanced to complete the sentence completion and concept matching (or "category") tasks. This graph covers the first eight weeks of the intervention. Data is given both for z-scores as compared to a normative base obtained by administering the tasks to children in a Western Massachusetts school system. The slight dip on nonword performance for the eight week is probably artifactual and due to the (relatively) small number of participants.

The data was collected using the CAAS (Computer-based Academic Assessment System), which I will give more detail on in the method section. Here it is sufficient to say that it is a computer-based system that measures both the accuracy of the response and the response time for verbal answers to stimuli presented on the screen. The "word" task involves a single word that must be read, "nonword" task a single nonword, "category" task a pair of words which the child must distinguish in terms of being members of the same group or not (available groups are presented to the child at the onset of the task) and the "sentence" task involves a

52
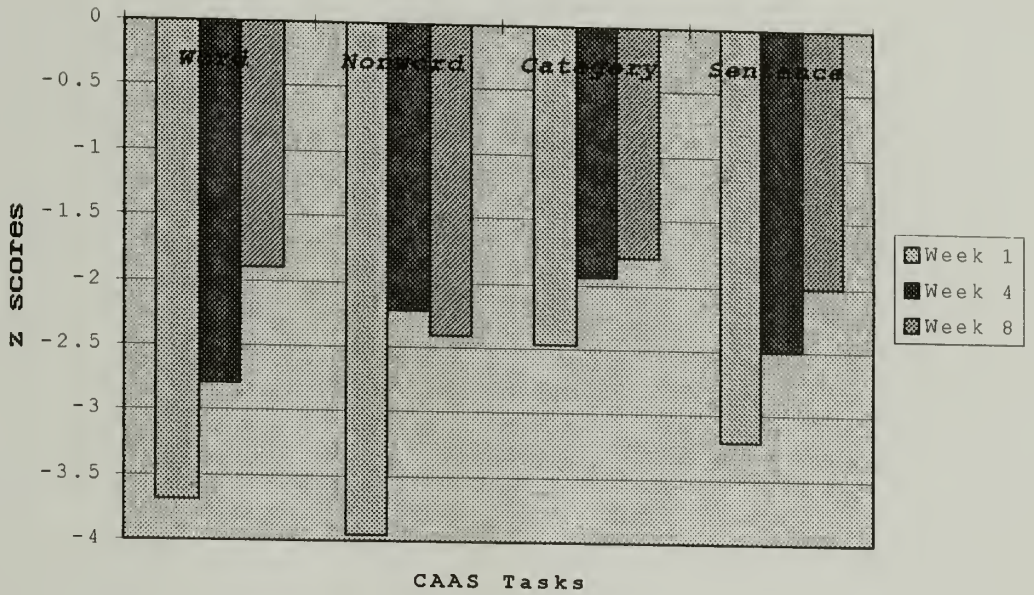
Figure 1.   Gains on CAAS Tasks for Dyslexic Elementary
Students at LATAS in Terms of Z Scores

sentence with a blank that must be filled in by one of two choices.

As can be seen, the children are making significant progress in deciphering *words they have not been practicing*. This indicates that they are transferring the knowledge that they have gained from the treatment to other words. In addition, their performance is improving on the other tasks as well (even nonword performance shows a net gain), indicating that they may be making global reading improvements.

This data is very heartening, and still more so are the comments by parents and the children themselves, a flavor of which is provided in Royer (1997). Many of the children that undergo this treatment truly believe that it is helping them get better at reading, and some have actually become enthusiastic readers. Granted, many of them are still well below their peers in terms of ability, but any progress at all can serve to elevate self-esteem enough to make kids willing to believe in themselves again, which serves to increase performance even further. It is like a reverse Matthew effect.

The research reported in this thesis was an attempt to perform a similar intervention with dyslexically-diagnosed college-aged adults. It was expected that the participants would increase on their performance in terms of reading the

words on specific lists that were provided for them (which were drawn from a textbook of their choice to increase the relevancy for them), and also that they would be able to transfer some of this newfound ability to words that they had not previously encountered. Methods similar to those used in the LATAS interventions for children were used, but they were modified to be appropriate for college-level adults.

CHAPTER II

METHOD

Participants

There were three participants in this study, who I will term A, B, and C. These participants were referred to the study through the efforts of James M. Royer and Donald J. Bolger, and were recruited through psychology classes in which these people were involved.

Participant A was a male, senior-level education major. He was diagnosed as being dyslexic in 1995, during his sophomore year of college. He heard about the study from Dr. Royer through his Educational Psychology class and entered into it out of curiosity.

Participant B was a male, junior-level chemistry major who heard about the study through a recruitment blitz on the part of Donald Bolger. He was a resident of an Eastern European country until 1993 when he moved to Boston, and has been speaking English ever since. He experienced trouble in reading, and had a strong suspicion that he was dyslexic, although he had never gone through the official testing procedures. His initial test results (as will be shown later) did indicate that he had difficulty at the word

recognition stage of reading, and thus he was able to continue with the program.

Participant C was a female, sophomore-level psychology student who was also taking Abnormal Psychology and was recruited in the same fashion as B. She was diagnosed as being dyslexic in high school and experiences significant difficulties in reading, especially in the field of sounding out words.

In addition to the three subjects that completed the study, two others were recruited through the efforts of Donald Bolger and given initial tests. Neither one demonstrated any deficiency in word recognition, nor did they have any diagnosis from an outside source. One seemed to have some (but only very minor) difficulties at the comprehension level, while the other merely felt that she was not reading as well as she thought she should be, and actually had the highest recorded scores on many of the administered tests.

All of the participants that continued past the initial assessment procedures were informed that the study was an experimental intervention and entered into it under a full understanding of what was going to happen and the potential alternatives in terms of results. Compensation for their time was given to each participant, including those who did not continue onto the intervention stage, in the form of

fifteen dollars and research credit (which can be used to raise class grades in participating psychology courses). This compensation was dispensed at the end of each participant's involvement with the program.

Apparatus I: Initial Assessments

At the beginning of the experiment, all of the participants, including the two who were later discontinued, underwent an initial assessment procedure designed to determine whether their disability lay in the realm of poor word recognition skills or not. Participants who do not have difficulties at the word recognition level would not benefit from the intervention, and this screening allowed me to avoid wasting anybody's time. Two of the people initially tested did not have difficulties at this word recognition level, and thereby did not continue with the intervention.

The initial screening battery of tests can take between an hour and two hours to complete depending on the participant. All the tests were administered on the same day with the exception of A, for whom two days were be taken for the screening procedures, due to time constraints in A's schedule.

Sentence Verification Technique Tests

The Sentence Verification Technique (SVT) is a
technique designed by Royer, Hastings, and Hook (1979a,
1979b) for the purpose of measuring both reading and
listening comprehension (Royer, Kulhavy, Lee & Peterson,
1986). Both the listening and reading tasks consist of
three passages of twelve sentences each. Examinees either
read or listen to the passages presented via audio tape
recorder, depending on the type of task. Each passage is
followed by sixteen test items to which the participant must
respond. These are read from the sheets for the reading
comprehension section or heard off the tape for the
listening section. Each response item consists of a
sentence for which the participant must decide whether or
not it means the same thing as a sentence in the passage
they just read or heard. Responses are marked by filling
the corresponding bubble for "yes" or "no" on a standard op-
scan answer sheet, which were graded by hand afterwards.

There are four types of sentences in the response
items: originals, paraphrases, meaning changes, and
distracters. Original sentences are ones that are found
verbatim in the text of the passage which the participant
has read—the response to whether the sentence means the same
thing as one in the passage is therefore obviously "yes".

Paraphrases are sentences that are worded differently (as differently as possible) from a sentence in the original passage but preserve the meaning of the particular sentence in question. They also garner a response of "yes" for equivalent meaning. Meaning change sentences change only one or two words from an original sentence found in the passage, but the changes are such that the meaning is completely altered. The proper response to these items would be "no". Finally, distracters are sentences that have a similar syntactic structure to a sentence in the passage and are consistent with the overall theme of the passage but do not mean the same thing as any sentence in the passage. For example, the distracter sentence for a passage about grooming horses might talk about the need to shoe horses properly, a topic that could have been in the passage but was not. Distracter sentences would have a correct response of "no". Instructions on how to construct these tests are given in more detail in Royer (1990) and Royer, Greene and Sinatra (1987).

In these tests, four response items of each type are used for each passage. An original, paraphrase, or meaning change sentence is constructed to correspond to each sentence in the passage, with four distractors added as well. The test sentences are ordered randomly save that the test sentences corresponding to the first half of the

passage are placed in the first half of the response items to reduce the effect of short-term memory on the answers to the test (Royer, 1990; Royer, Carlo & Cicero, 1992).

There are two forms available for this test, Form A and Form B, both of which were used. The forms are identical save that the passages that are on the listening task in Form A are on the reading task in Form B and vice versa. All six passages (three for listening, three for reading) were taken from the Nonfiction in Brief section of the *New York Sunday Times Book Review* from the late 1960's and have been used in previous research (Cisero et al., 1997; Royer, Marchant, Sinatra, & Lovejoy, 1990) with college students and adults with reading disabilities, as well as being used for assessment purposes in LATAS. An example of such a passage is provided in Appendix A.

Reliability studies have shown that the SVT is reliable in a variety of contexts (Royer et al., 1986; Royer & Hambleton, 1983). The SVT has also been shown to be valid on a variety of measures: sensitivity to text predictability, sensitivity to differences in reading skill, sensitivity to differences in prior knowledge, sensitivity to text characteristics, performance in relation to working memory capacity, measurement of passage rather than sentence comprehension, relationships with other measures, prediction of learning performance, and measurement of listening and

reading comprehension. For a detailed summary of the validity efforts, see Royer (1990) and Cicero (1995).

The percentage of correct responses on the SVT was collected for each individual and transformed into a percentile rank based on the performance of college-aged peers. This was done by comparing the participant's performance to that of undergraduate students from the University of Massachusetts in Amherst (Royer, Lynch, Hambleton & Bulgareli, 1984) and placing the subject at the appropriate percentile. The information was used in the assessment of whether or not a reading difficulty was present.

Computer-Based Assessment

In addition to the Sentence Verification Technique, several computer-based assessment measures have been developed by the staff at LATAS. These assessments comprise the Computer-based Academic Assessment System (CAAS). They were designed to provide a measure of both reaction time and accuracy, thus providing a more accurate picture of a participant's performance than most previous measures would have allowed.

Equipment

These computer-administered tasks were presented on an
IBM-compatible computer that operated using MS/DOS. The
stimuli were presented on the screen, and to respond the
subject was asked to vocalize an answer into a microphone
which was attached to a "student box" apparatus. This
apparatus was connected to the service port of the computer
and records all response times from the moment of the first
significant vocalization the participant makes into the
microphone after the onset of the stimulus. Because of the
computerized nature of the recording of the response time,
accuracies can be found to the millisecond.

The items were scored via a "scorer" box, from whence
the correctness of their response was indicated by pressing
the appropriate button, whereby the computer reports the
value. These boxes allow reaction time (from onset of
stimulus to the time where the microphone registers the
first vocalization by the participant) to be measured
explicitly, and to have the response paired to a
corresponding value of "correct", "incorrect" or "erased".
A "correct" response is recorded by pressing the red button
on the left of the "scorer" box, an "incorrect" response by
pressing the blue button on the right, and an "error" by
pressing both simultaneously. The potential for inter-rater

reliability problems inherent in this system was controlled by my being the only person who ran the participants. The assumption was that my subjective judgments, where necessary, were of a similar nature each time. The CAAS system that works with these boxes was designed by James M. Royer and his associates specifically for use as an assessment measure.

Tasks

Eight tasks were presented to the participants to measure a variety of the component parts of the reading process (Royer & Sinatra, 1994). For each task, the participant was instructed to respond in the appropriate manner as quickly and accurately as they were capable of doing. The tasks were administered in the order that they are listed here. Examples of the stimuli presented in each task are given in Table 1. The first two tasks were designed by James M. Royer and the LATAS team. The remaining tasks, with the exception of the Category Match Task, were designed by Cheryl Cisero.

Simple Reaction-Time Task. This task is a basic measure of the baseline response time to making a vocalization in response to an unambiguous visual stimulus. As this task is very easy for all participants (even the

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youngest children seen at LATAS have no problems with it) it serves the secondary function of acclimatizing the subjects to the computer testing environment. Participants see either "***" or "+++" presented on the computer screen and respond by saying either "star" or "plus" into the microphone as appropriate. There are fifteen trials in this task.

Letter Naming Task. In this task the participants are presented with a single letter, either capitalized or lower case, on the screen, to which they respond by saying the name of the letter into the microphone. They are presented with a total of twenty letter trials.

Word Naming Task. This task presents a word on the screen which the participant reads aloud into the microphone. The words are grouped into six categories: one, two, and three-syllable words which are divided into categories of regular and irregular phonetic structure. Regular phonetic structures are those in which grapheme-phoneme correspondences are relatively invariant and follow standard English phonetic rules. Irregular words contain letters with grapheme-phoneme correspondences that are exceptions to the phonetic rules. Examples of such exceptions are the "b" in "dumb" or "subtle" or the ending "gue" combination in "tongue". The criteria that were used to form these categories were taken from Venezky (1970).

Half of the words in all categories were slated as being low frequency (less than 50 occurrences per million) and the other half were high frequency (over 100 occurrences per million) as defined in Francis and Kucera (1982). There are a total of 40 words presented, 10% of which are from each of the first two categories (one syllable words) and 20% are from each additional category.

Nonword Naming Task. This task is very similar to the word naming task, except that the stimuli are not real words, but nonwords that are phonetically pronounceable as if they were real words. The participant responds by reading the nonword aloud into the microphone. The nonwords were produced by modifying one letter in each syllable of the list of words in the word naming task. As an example, a word like "gather" might be changed to "fasher" to become a nonword (this is not an actual example from the task). In irregular words, an attempt was made to preserve the structure that made the word irregular so that the nonword can also be pronounced as if it were irregular. Unlike words, which usually have only one correct pronunciation (allowing for accents, of course) nonwords can be pronounced in many different ways and that are still phonetically correct. Because of this, they are scored as correct if the pronunciation that the participant gives is at all possible phonetically, given the letter combinations present in the

given nonword. The number of nonwords presented for each category is equal to that of the words.

Category Match Task. In this task the participant is presented with two words that fall into one of four categories that were presented at the beginning of the task, namely mathematics, history, literature and science. The participant responds to the stimulus by saying the name of the appropriate category into the microphone. The words from each category only appear in one set of category pairs, so there is no chance of remembering the appropriate categories for words across trials in the same testing run. The words used in these categories were compiled by Loel Tronsky in 1997 for the purposes of use in this and related studies, using a variety of sources. The participant is presented with 24 word pairs, with an equal number of pairs from each category. The task was designed to measure the process of word-meaning extraction.

Sentence Completion (Semantics) Task. This task was designed to be a measure of higher-level semantic processing. In it, the participant is presented with a sentence in which one word is absent and needed to complete the sentence. In the blank provided by the absent word, two words are presented (one on top of the other). The participant's task is to choose the word that best completes the sentence and say it aloud into the microphone.

Responses like "the top one" and "the one that starts with an 'a'" are also accepted from those who have severe reading difficulties to ensure a baseline of 50% correct. The word choices are relatively complex vocabulary words—two or three-syllables and both regular and irregular pronunciation. Eighteen sentences are presented to each subject.

Rhyme Task. This task is one of three (along with the initial phoneme and final phoneme tasks) designed to measure phonological awareness. In this task, the participant is presented with two words and responds "yes" if these words rhyme and "no" if they do not. The words sets are divided into four categories: those that have the same ending structure and do rhyme, those that have the same ending and do not rhyme, those that have different endings and do rhyme and those that have different endings and do not. All the words in this task and the two following tasks are single-syllable words and have been determined to be known by at least 80% of twelfth grade students (Dale & O'Rourke, 1976). Each participant is presented with 32 word pairs, with equal numbers from each category.

Initial Phoneme Task. This is the second of the three tasks designed to measure phonological awareness. The participant is again presented with two words and has to respond "yes" or "no" based on whether the first phoneme

(for example, the "p" sound in "plus" or the "f" sound in "phone") is the same or different between the words. There are four categories of word pairs that correspond to the categories for the rhyme task, with the same number of stimuli shown.

   Final Phoneme Task. This task is nearly identical to the initial phoneme task, save that the phoneme of interest is the last phoneme in the words. All other parameters are identical.

Analyzing the Data

   The CAAS program cleans the data automatically by eliminating all response times faster than 250 milliseconds (which was deemed to be impossibly fast) and all responses that are more than two standard deviations above or below the mean time. The mean and standard deviation for the response time are then recalculated and presented along with the percent accuracy of the responses that were kept. Once CAAS data was collected on each participant, it was entered into a spreadsheet program on the computer (created using SPSS for Windows 6.0, ©1993) wherein the accuracy and response time data were compiled into a single score. These compiled scores were then compared to normative data

Table 1. Examples of CAAS Tasks

Task	Sample Stimuli			
Simple	***	+++		
Letter	A	g	L	z
Word	sprint	plight	kitten	canoe
	baritone		pseudonym	
Nonword	sprict	clight	fitken	yanob
	larotine		psendinom	
Category	pi	infinity	--"math"	
	epic	onomatopoeia	--"literature"	
	Chippewa	carpetbagger	--"history"	
	hormone	titration	--"science"	
Sentence	A district attorney's job is to			
	prosecute			
	perpetrate the defendant.			
Rhyme	pain	main	--"yes"	
	shoe	two	--"yes"	
	food	good	--"no"	
	trip	lace	--"no"	
Initial	chain	chair	--"yes"	
	phase	flush	--"yes"	
	knit	kite	--"no"	
	child	open	--"no"	
Final	size	doze	--"yes"	
	trace	lass	--"yes"	
	cheese	chess	--"no"	
	niece	splurge	--"no"	

collected by Lisa Kraner at the University of Massachusetts
in Amherst in the second half of 1997 and the beginning of
1998 and by Cheryl Cisero at Westfield State College in 1994
and Wayne State University in 1997. Most of the
participants used in the normative set were undergraduate
psychology students (who received research credit for their
participation), and as such the normative data is probably
not representative of the general student body. It is,
however, adequate for our purposes, which are to establish a
ranking of the participants on the various sub-skills and to
be able to measure rank improvement over time. A more
detailed description of the procedure used to collect these
percentile rank scores can be found in Rath and Tronsky
(1997). Specific information on the formulae used to
calculate combined scores is included in Appendix B. These
combined scores are ultimately expressed as standard scores,
which will be the basis used to describe them here.

Additional Information

The CAAS system has been shown to be both a reliable
and valid measure of the various components of the reading
process. Sinatra (1989) demonstrated a reliability
coefficient of 0.9 while Royer and Sinatra (1994) found the

reliability to be between 0.88 and 0.97. Sinatra (1989)
also analyzed CAAS using a variety of validity measures.
She confirmed that children of higher grades perform better
than those in lower grades, that better readers do better on
the tasks, that CAAS performance corresponds very well to
teacher ratings and that there are different profiles on the
CAAS system for different types of readers: dyslexics,
children with non-reading related learning disabilities and
nondisabled students. In addition, Royer (1997) has
demonstrated that performance on the CAAS system is
consistent with the theories of dyslexia presented earlier
in this paper.

Cisero et al. (1997) also achieved similar results
using an adult population. They found that the system was
valid in that nondisabled adults performed better on all
tasks when compared to their disabled peers and that the gap
broadened with increased task difficulty. She also found
that CAAS data in conjunction with the SVT was able to
predict learning disabilities with an accuracy of 70 to 92%
depending on the existence of an "other" category and that
the CAAS could be used to recognize specific areas of
difficulty. She also found that the results supported the
above-mentioned theories of dyslexia.

When combined, the CAAS and SVT provide an indication of the nature of the difficulty that the individual has with reading. As the proposed intervention method is designed to work on improving a subject's sight vocabulary and, hopefully, his or her computational phonological skill it is inappropriate for individuals who are not deficient in word decoding skills. The initial testing allowed participants to be "weeded out" if their disabilities (or lack thereof) were such that they would not benefit from the program, such as when difficulties fell exclusively in the domain of comprehension.

Those participants identified as having reading difficulties who have a difficulty in decoding words, which is thought to be indicative of a phonological processing deficit, have been shown to have a specific profile of CAAS/SVT performance (Royer, 1997). On the SVT, this profile often shows depressed performance (measured by percentile rank) on the reading comprehension task in comparison to the listening comprehension. This is a primary indicator that a reading disability is, in fact present. This is not always the case, however, because the listening portion of the SVT has a timed component (the audio tape will progress on a steady clip, whether the

participant wishes to go that fast or not) while the reading portion does not (the participant can read as slowly and carefully as he or she chooses). Because a reading difficulty that is present because of a difficulty in the efficiency of word recognition generally results in slower reading time, which would not be measured by the SVT, the presence of a higher score in reading comprehension is not necessarily indicative that there is no reading problem present.

On the CAAS data, dyslexically-diagnosed individuals typically perform well on the simple reaction time and letter naming tasks, but perform much more poorly than their peers on the higher-level tasks. They tend especially to be depressed on the nonword, sentence, rhyme, and the initial and final phoneme awareness tasks. An example of a typical profile, using standard scores compared to the normative group, is given in Figure 2.

Using this typical profile as a guideline, participants were selected to proceed with the intervention based on the nature of their problems. Individuals who do not show any deficit in words, nonwords or the phonemic awareness tasks generally do not have difficulties at the word decoding level (although they may show depressed performance at higher levels), and those that fit this mold did not continue with the program, while those that did show such

Figure 2. Typical CAAS Profile for a Dyslexic College Student
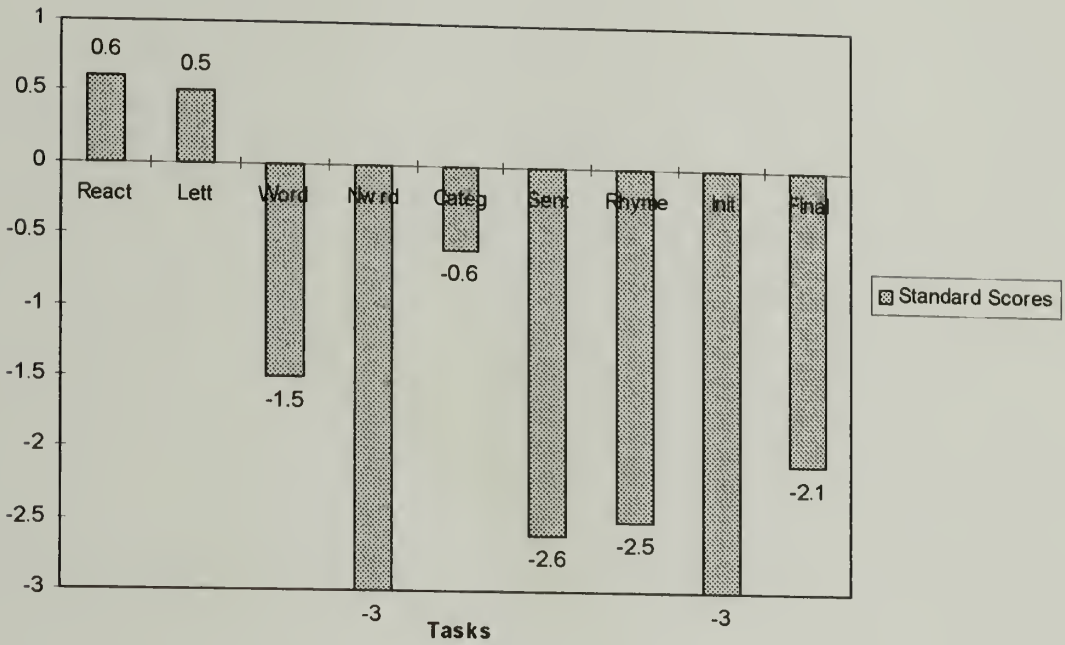
React = Simple Reaction Task
Lett = Letter Task
Nonwd = Nonword Task

Categ = Category Task
Sent = Sentence Task
Ini = Initial Phoneme Task

difficulties were asked to continue. Two individuals did not show any substantial reading difficulties on any of the tasks, while three did, all (to some extent) in the area of word recognition. These were participants A, B and C, and all three agreed to continue with the intervention. Their initial profiles on the SVT measures and CAAS tasks are given in Figures 3 and 4, respectively.

All participants were informed of the reason for the initial assessment, and those who were found not to be eligible for the intervention were informed of such and given the reasons behind the selection. All participants were given a copy of the results of the initial assessment, to use for whatever purposes they wish, along with the warning that the information is not a formal diagnosis performed by a licensed diagnostician and should not be treated as such.

Apparatus II: The Intervention

Once the participants had been selected on the basis of whether or not they had difficulty with word recognition and therefore could benefit from the intervention program, they were given the opportunity to either continue in the study or not. They were also informed that they could discontinue
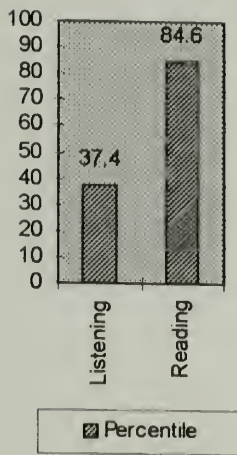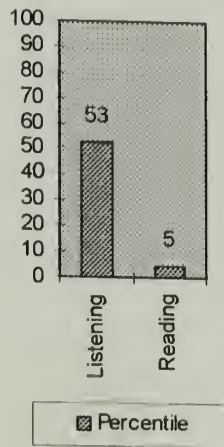
Participant A   Participant B   Participant C

Figure 3.   Initial SVT profiles for Participants A, B, and C.

Participant A

Participant B
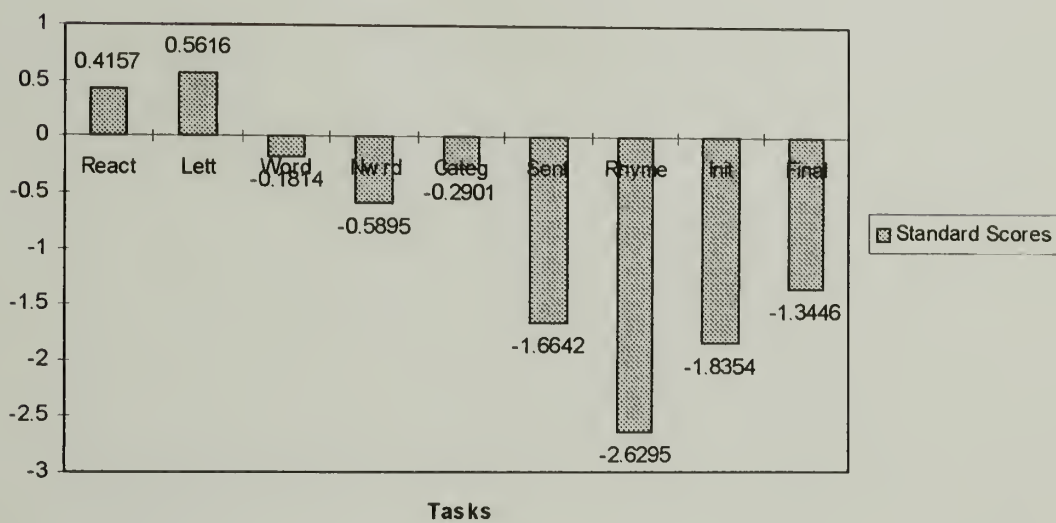
Figure 4. Initial CAAS profiles for Participants A, B, and C.

Figure 4. Continued

Participant C
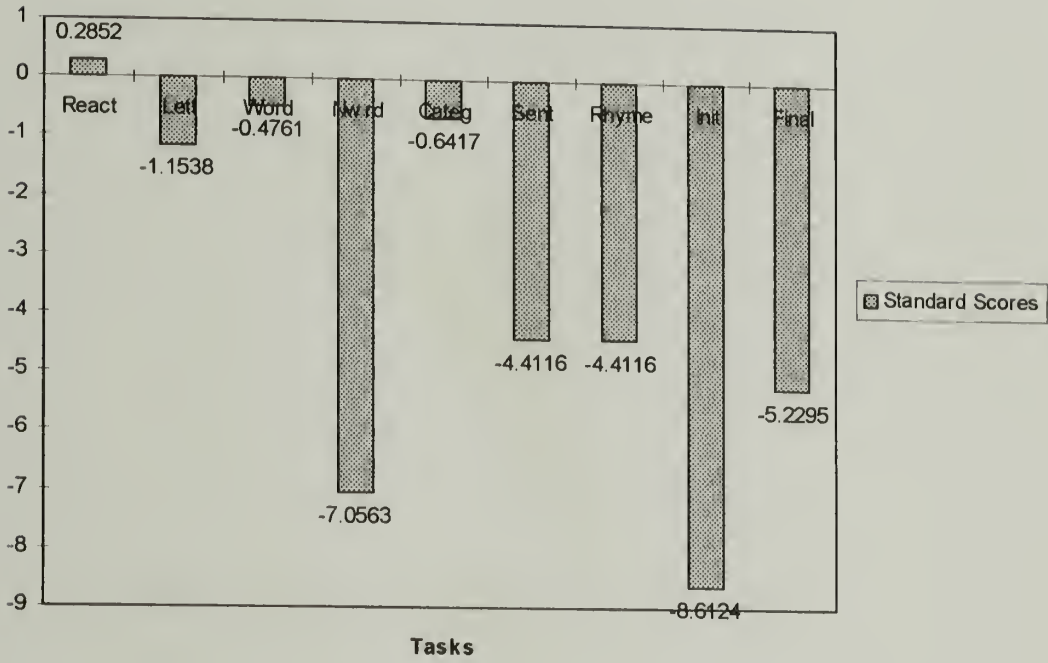
the intervention at any time, although they had to stay for eight weeks in order for their data to be used.

The intervention was of the same general format for all participants, but modified for each individual such that the materials used were designed to mesh specifically with his or her field of study. The process was as follows.
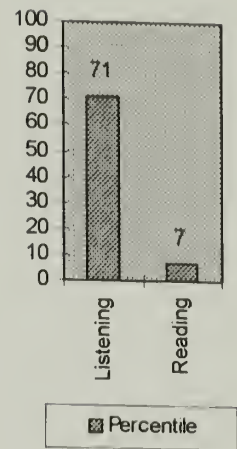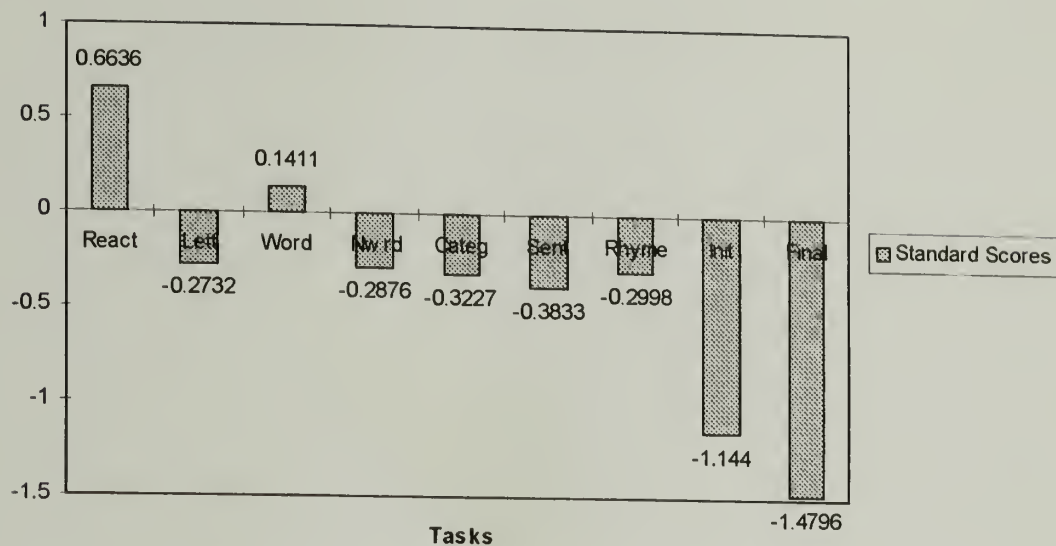
Home Materials

Each participant received a series of materials to use at home on a daily basis in order to improve his or her sight vocabulary. These were: several word lists, a tape of the words, and a home graph.

The word lists consisted of several pages (four per list, and as many lists as the source material permits) of 40 words apiece. The lists were printed on pages with four columns of words and ten words to a column. In some cases, short phrases were used in addition to words. The word lists were drawn from the glossary of a textbook of the participant's choice: Woolfolk (1998), an educational psychology text, in the case of A and Halgin and Whitbourne (1997), an abnormal psychology text, in the case of B and C. The glossary terms were converted into a list, keeping the order as random as possible through sorting the words alphabetically by a letter inside the word (typically the

third letter, but it varied depending on how many words had the same prefix, etc.). Three lists were made for both the abnormal and the educational psychology conditions, although the third educational psychology list was only three pages instead of four, due to a paucity of available words. Appendix C gives an example of such a list.

As the participants may have had difficulty pronouncing the words without some sort of guidelines, they were provided with an audio tape on which I had recorded myself reading all of the words on the list (with proper pronunciations accounted for). They could use this tape however they like, but it was recommended that they listen to the entire thing once while reading along before attempting any practice, and that they refer to it whenever they had difficulty with an individual word. By the reports of the participants, the tape was helpful with some words, but unnecessary for most.

The third piece of the home materials was the home graph. This was a chart on which the participant was asked to record the time that it took him or her to read through each page (on average) every day that he or she performed the home practice. Once the time asymptoted on a particular list, the participants were instructed to begin practicing the next list, which they could graph on the same home graph sheet.

The sheets have a series of columns to represent the day of practice, and a scale for time. For each day the participant places a dot at the appropriate time for that day's practice, and the dots are connected by lines to show the progress that the subject is making.

Weekly Reassessment Materials

Once a week (or sometimes more often, as time pressures dictated towards the end of the semester), the participants were asked to meet with me and be reassessed to measure their progress. Reassessment was performed using the CAAS, but with some modifications.

Since it would be counterproductive to measure progress using the same tasks every week as were used in the beginning (practice effects would start to be seen on the tasks due to memorization of sentences, etc.), new CAAS tasks were created that related to the specific material which the participant were practicing at home. A detailed description of how to create such tasks is given in Rath and Tronsky (1997). Every week (with the exception of the fourth and eighth weeks of the intervention, on which the same tasks that were given during the initial assessment were be readministered), the participant was run on three

modified CAAS tasks: word naming, category matching and sentence completion. These are detailed below.

Modified Word Naming Task. This task works in the same way as the regular word naming task described above, but the words are different. There are six categories of words, and each category contains words that are found on different portions of word lists. Thus the first and second categories contained words from the first list that the participant was practicing, the third and fourth were from the second list and the fifth was from the third list. The final category was comprised of 125 words that were taken from the Vis-Ed English Vocabulary Cards (© 1986 Visual Education Association, Springfield Ohio). These words are of adult level and very difficult. The same words from this category were used for each participant.

Modified Category Task. This category task was approximately the same as the task in the initial assessment but used words and categories drawn from the source material provided by the participant. Categories were selected on the basis of clear distinctions and relatively easy identification. For the educational psychology material the four categories were "statistics", "teaching methods", "cognitive terms" and "conditions" (meaning both physical and mental conditions). The categories for the abnormal

psychology material were "disorders", "analysis", "treatment" and "body parts".

Modified Sentence Task. This task was also basically similar to the sentence completion task described above, except that used vocabulary from the source material provided. Sentences were composed in such a way as to require the participant to know the meaning of the words that need to be chosen between in order to answer the question correctly (without guessing).

Progress Measures

Several measures were used to determine the extent to which the intervention was effective in improving the participants' performance in general reading skills, as opposed to performance on the specific materials that they were practicing. The first of these was the complete battery of CAAS tasks, which were administered both at the time of the initial assessment and during the fourth and eight sessions of the intervention. In addition, there were two other measures used to measure improvement in reading ability: a reading sample and an inference test. Both were administered on the first session of the intervention and on the eighth.

The Reading Sample. The participants were asked to
read a passage from the textbook that they chose to work
from out loud, into a microphone, which was attached to an
audio tape recorder. The passages used were pages 392-394
in Woolfolk (1998) for A, a passage on self-efficacy, and
pages 334-335 in Halgin and Whitbourne (1997) for B and C, a
passage on schizophrenia. The same passage was read on both
occasions. These passages were analyzed by recording the
number of words read per minute (on average), a general
measure of reading fluency and by recording the average
number of reading errors in the sample per 100 words read.
An error was defined as a word either being skipped or
mispronounced. It was reasoned that this would allow an
analysis of whether the participants' actual reading
abilities were improving as a result of the treatment.

The Inference Test. The inference test comprised of a
twelve-sentence passage from the text (found on page 558 in
Woolfolk (1998) in the case of A and on pages 218 and 219 in
Halgin and Whitbourne (1997) in the case of B and C) which
the participant had to read. After they had read through
the passage they were instructed to turn to the next page,
on which there were 16 statements, which could be inferred
as being true or false, based upon the information from the
passage and background information that they might or might
not know about the subject matter. They were not able to

reread any of the passage once they began responding to the statements. The statements were formed using the format developed by Royer, Cisero and Carlo (1993), where half were near inferences (statements that could be verified or falsified based entirely on information in the passage) and half far inferences (which necessitated some knowledge of the topic in order to figure out). For the second administration of the test, the same passage was used, but the statements were partially modified such that the order in which they were presented was altered and the wording in some (but not all) was changed so as to reverse the meaning of the passage. In this way an attempt was made to force the participants to read each statement carefully in order to do as well, or better, on the test as they did the first time they took it. It was reasoned that, through this measure, it could be determined whether there was any substantial increase in the participants' ability to understand the material at a deep enough level to draw inferences or not. A sample of an inference test, with both sets of statements, is given in Appendix D.

Procedure

Participants, after being recruited through their respective classes, scheduled an appointment with me for

about two hours, occurring across either one or two days, for the initial assessment procedures, as described above. In addition, they met with me again after at least a day or two so that the results of the initial assessment could be presented to them, at which time they decided whether they wished to continue with the intervention program or not, assuming that their reading difficulties made them eligible to do so. All three that qualified to continue with the intervention decided to do so. Throughout the assessment procedures the intentions of the experiment were made explicitly clear, and both the strengths and limitations of the tests which were performed were clearly stated. They were informed that they were free to leave at any time, no questions asked, although none chose to do so. In addition, they were informed that their names will not be used in any way, and neither would other information that is directly traceable to them be used in my final reporting of the data. The participants were given informed consent forms which explicitly state this and required their signature in order to proceed.

The participants were run on the SVT first, followed by the CAAS tasks, on either the same day or the next. For each task, percentile scores (for the SVT) or standard scores (for the CAAS tasks) were calculated and compared to the expected patterns for a reader deficient at word

decoding. Those participants who meet the profile were invited to continue with the intervention, with the understanding that they are free to leave the program at any time with no penalty for doing so. Those that do not were be thanked gratefully for their participation and presented with the monetary reward of fifteen dollars (those who continued with the intervention received their reward later in the program). All participants received a copy of the results for of their initial assessments, in which the CAAS standard scores were translated into hypothetical percentile scores for ease of understanding, to do with as they saw fit.

Those participants who were eligible for the intervention program all opted to continue, whereupon they were asked to bring a textbook (containing a glossary) in as soon as possible from a class in which they expected to have some problems with the reading material. The glossary was copied from the back of this text and use it to create word lists, CAAS tasks, an inference test and a passage for the reading sample specific to the individual participant, in the process described above. At that time the meeting for the first session of the intervention was scheduled.

When the participants came in on the first session of the intervention, they were run through the newly created CAAS tasks: the specialty word, category and sentence

completion tasks. At this time they will have had no practice with the material. They were also administered the inference test and recorded a reading sample. After completing the CAAS tasks they were given a copy of the word list (copies of all materials were also kept for my files), a home graph, and a tape of the words being read aloud as a guide to proper pronunciation. Each participant was provided with explicit instructions on how to use the materials, and asked to bring in the home graphs each week to have a measure of their progress. In addition, arrangements were made to meet with them on a weekly basis for the eight-session period of the program. In the case of B and C, who started fairly late in the semester, this ended up meaning that it was necessary to meet twice a week on certain weeks in order to fit in all eight sessions before the end of the academic year.

On their own time the participants read through a word list as fast as possible (keeping track of the time), striving for as much accuracy as possible. They were asked not stop to check their pronunciations until they had finished with the entire list. The average time that it took to read through a page was be computed and recorded on the home graph. Once the graph leveled out at a relatively fast speed, the participant began reading through the next list in the series. Once all of the lists had been

optimized in terms of reading speed in this manner, the participant was asked to go through the lists again, but this time to say a word or short phrase that was basically synonymous to the word being read. This practice should have been done five days a week and should have taken an average of about ten minutes per day.

In performing this home practice, only one of the participants, C, was able to complete reading through the lists. C did not, however, actually asymptote on her times, but rather switched to the next list while her time was still dropping dramatically. A proceeded through the lists more slowly, but did asymptote—he did not have the time to begin looking over the lists for meaning. Unfortunately, B forgot to bring in his home graph on the last session of the intervention, and did not produce it later, so no information is available on his home practice. The two home graphs that are available (which are cleaned up for the sake of clarity) are included on Figures 5 and 6.

For the remainder of the program, the participants continued to perform their home practice and met with me on a semi-weekly basis. During every session except the fourth and the eighth (which was the last session of the intervention), the participants were rerun on their individualized CAAS tasks. On the fourth and eighth weeks they were run on the same tasks that they were run in their

initial assessments. This provided a measure of the increase that the participants are making in their reading ability. Also, during the eighth session, the inference test was administered a second time (in its modified format) and another reading sample was collected.

At the end of the eight sessions, the participants were thanked for their participation and presented with their reward of fifteen dollars and research credits, if they desired them.
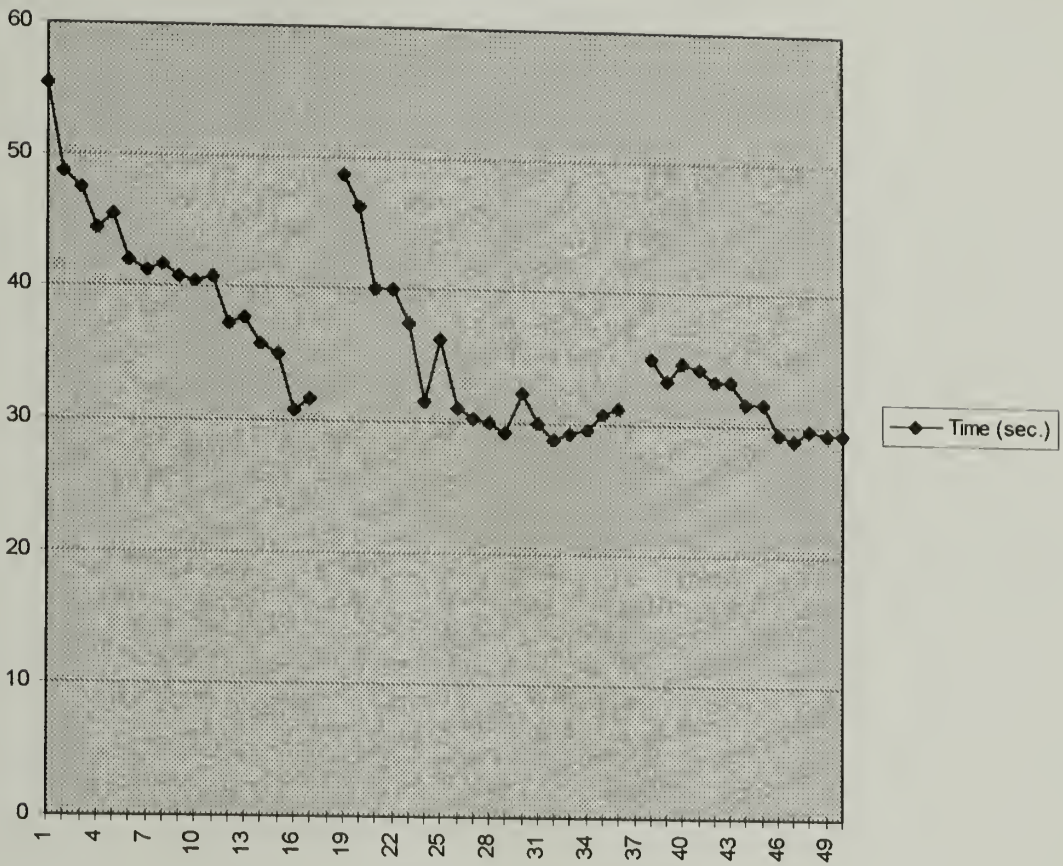
Time is in the average number of seconds per page. Each
series of points represents performance on a different
list, in order. Numbers on the bottom indicate the sessions
of home practice.

Figure 5. Home Graph of Participant A, Redone for Clarity
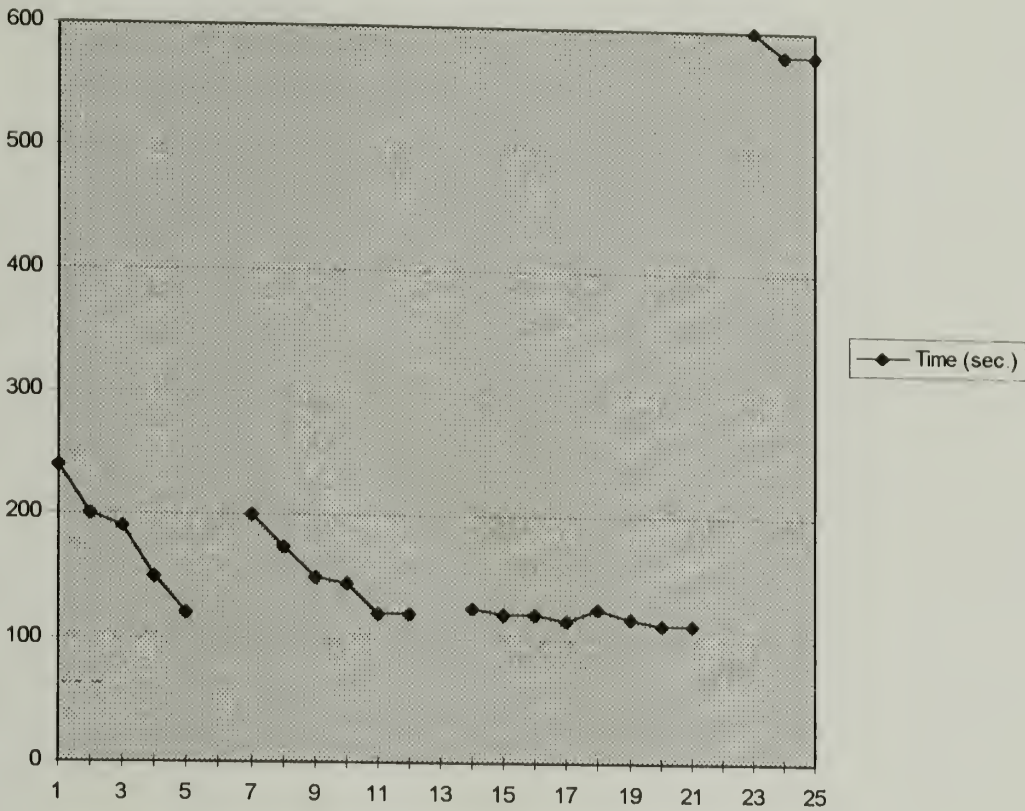
Time is in seconds. The first three lines represent the times for reading the average page of each of the word lists. The fourth line represents the time to go through an average page for meanings on the first list.

Figure 6. Home Graph of Participant C, Redone for Clarity

CHAPTER III

RESULTS

The results are presented in two sections. The first, entitled "Individual Results", details the tests results of each participant, individually, over the course of the intervention. The second, "Combined Results", looks at all the data put together, on which statistical analyses were run to determine whether or not there were any significant trends across the three participants.

Individual Results

Participant A

CAAS Performance on Educational Psychology Material. Participant A's performance on the computer tasks containing textbook-specific material is represented in Figure 7. In terms of the accuracies that A achieved on the various tasks, there is little change in the word task and the sentence task (although the latter seems to drop for a while before high accuracy is once again reached), while there is a trend of improvement on the category task. The response times, however, are more dramatic in that they fall in each of the tasks. This is especially important to note in the
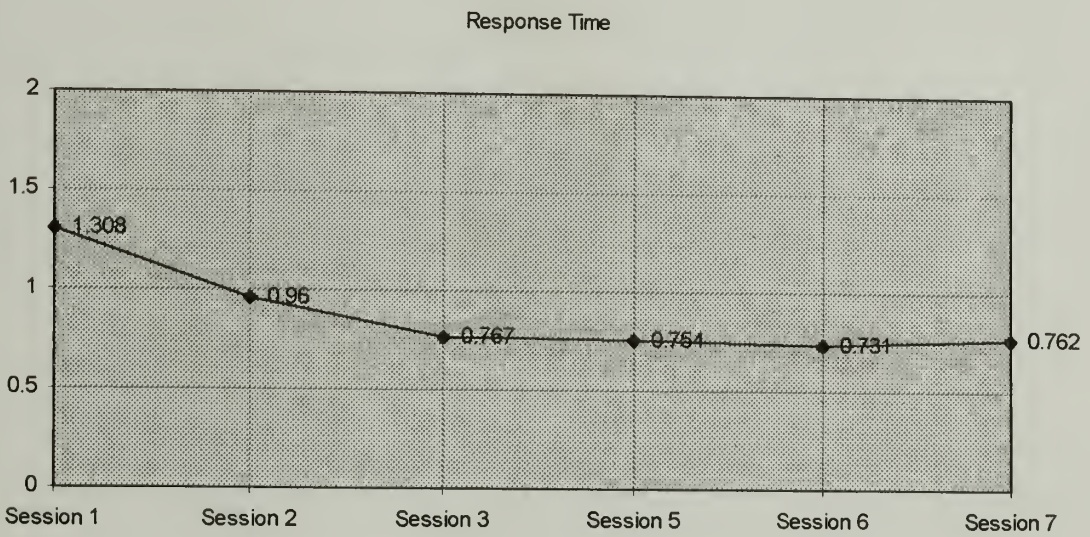
Word Task

Accuracy

Response Time
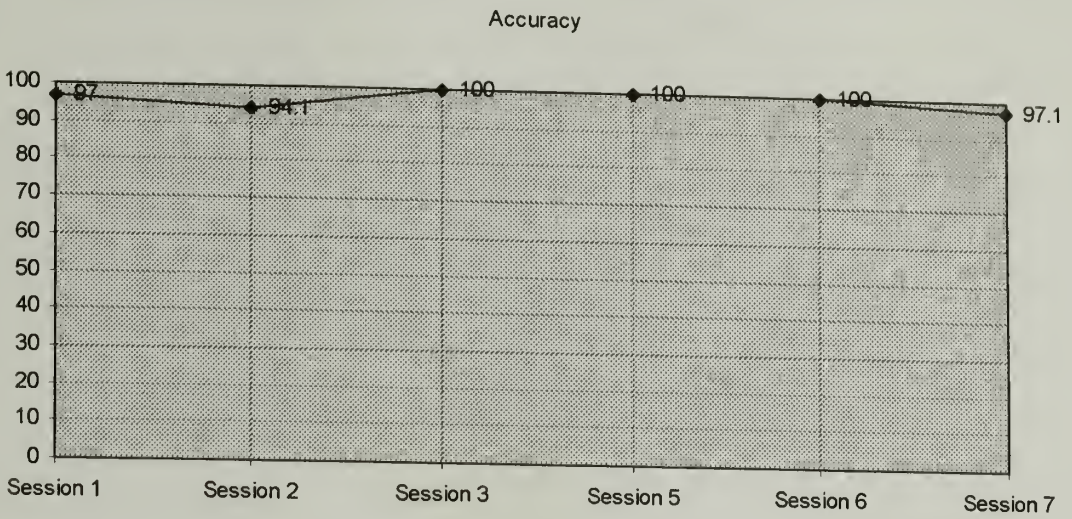

Figure 7. Participant A's Performance on Educational
Psychology Computer Tasks

95

Figure 7. Continued

Category Task

Accuracy

Response Time

96
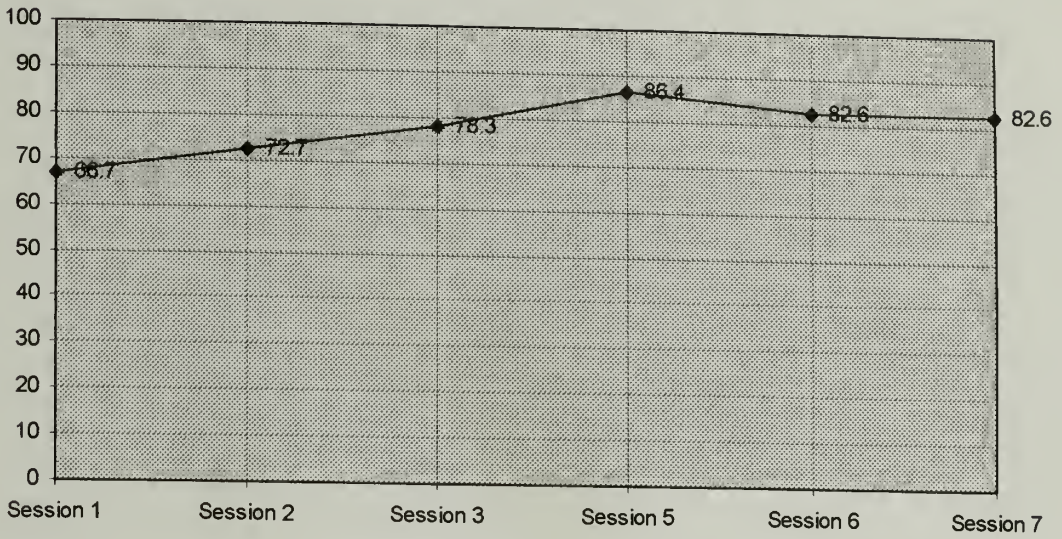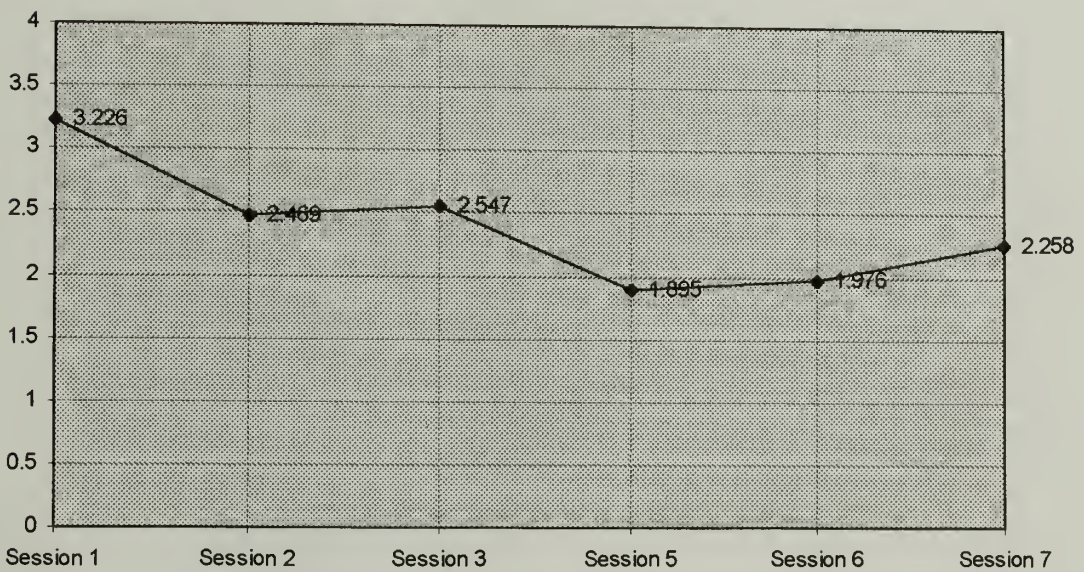
Figure 7.   Continued

Sentence Task
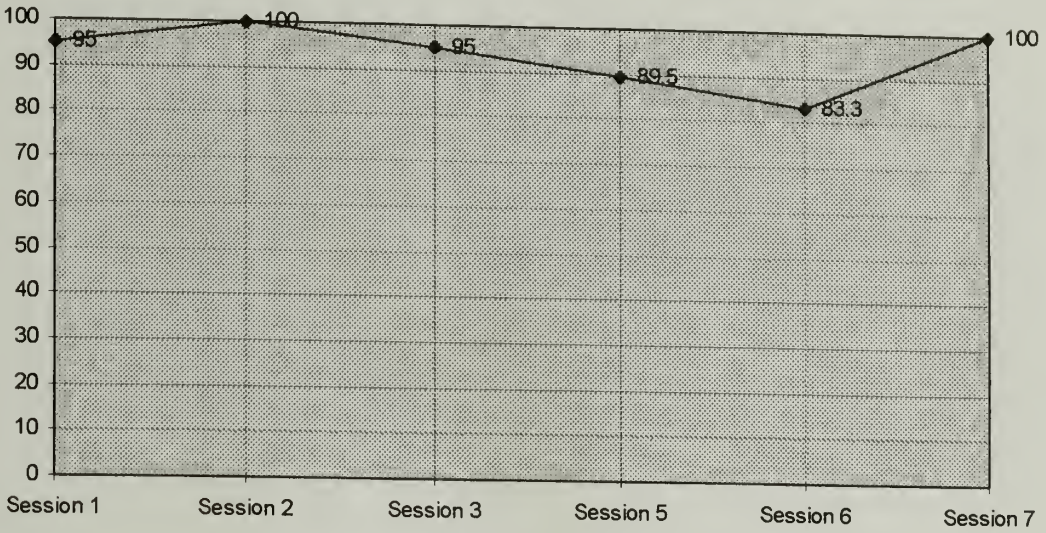
Accuracy
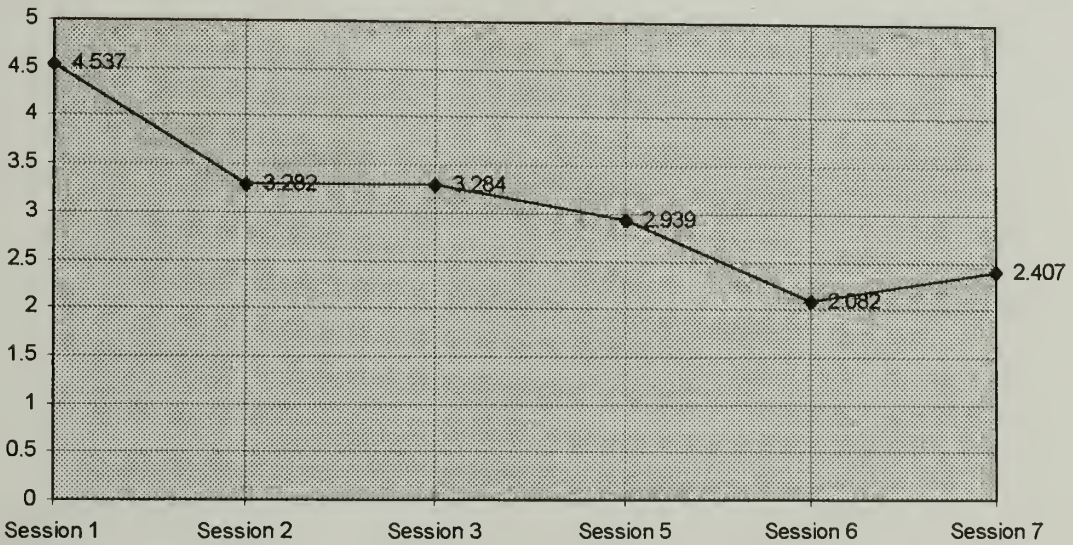
Response Time

Accuracies are in percent correct, response times in seconds.

word task, where there is a very large set of words from whence the items are being sampled.

The word task was broken down into six categories, the first two corresponding to the first list, the second two to the second, the fifth to the third, and the sixth to a set of non-practiced, difficult words, and it is possible to look at performance on these categories individually. This information is presented on Table 2. It should be noted that Figure 7 shows three sessions (3, 5 and 6) as having an accuracy of 100% while Table 2 makes it clear that there were errors in both sessions 3 and 6. This situation occurred because the CAAS system automatically deletes any response from the report of the individual's overall performance if the response time is more than two standard deviations away from the mean time for the task, but the items are kept in the report of the individual categories. In this case, the errors that were not reported in the overall word task performance took A significantly longer to respond to than all of the other items. It is also notable that there is a great deal of variability across the sessions in each category. This is primarily due to the sampling effect: the words that A saw were drawn from a large repository of words, and some of the words proved more difficult for A than others. Thus during sessions in which A was slower on certain category, the most likely

Table 2. Participant A's Performance Across Sessions on the Categories Within the Educational Psychology Word Task

	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6
Sess. 1	100.0 (1.313)	100.0 (1.296)	100.0 (1.329)	100.0 (1.075)	100.0 (0.933)	83.3 (1.838)
Sess. 2	100.0 (0.815)	80.0 (0.804)	100.0 (0.784)	100.0 (0.852)	83.3 (1.085)	83.3 (2.194)
Sess. 3	100.0 (0.789)	100.0 (0.742)	100.0 (0.755)	100.0 (0.724)	100.0 (0.677)	83.3 (1.209)
Sess. 5	100.0 (0.840)	100.0 (0.822)	100.0 (0.642)	100.0 (0.670)	100.0 (0.643)	100.0 (1.011)
Sess. 6	100.0 (0.805)	100.0 (0.653)	100.0 (0.729)	100.0 (0.626)	100.0 (0.790)	83.3 (1.268)
Sess. 7	100.0 (0.683)	100.0 (0.812)	100.0 (0.717)	100.0 (0.605)	100.0 (0.717)	83.3 (1.206)

Sess. denotes the session number
Cat. denotes the category number
For each session, accuracies are the top number and response times the bottom, in parentheses.

explanation is that he encountered a word (or perhaps more than one) that was more difficult for him than the words from the previous session. Since this effect is more pronounced when looking at individual categories, it is felt that a more meaningful measure of performance can be obtained through the analysis of the overall performance on the word task. Still, it is clear from the data that there seems to be an overall improvement in response time on each of the categories, including category 6, which exclusively contained words that A was not practicing.

CAAS Performance on Unpracticed Material. The standard scores for A's performance on the CAAS tasks measuring general, adult-level material as administered during the initial testing and at sessions 4 and 8 are presented in Figure 8, and the accuracies and response times for the tasks are found on Table 3. It is clear that A made substantial progress on most of the tasks, notable exceptions being the simple response time task (in which no real change was apparent), the letter naming task (in which there was a large amount of variance but whether or not there was real improvement is debatable) and the initial phoneme task (which he seems to have gotten worse at). The implications of the changes in performance on these tasks will be explored more fully when the data is combined.
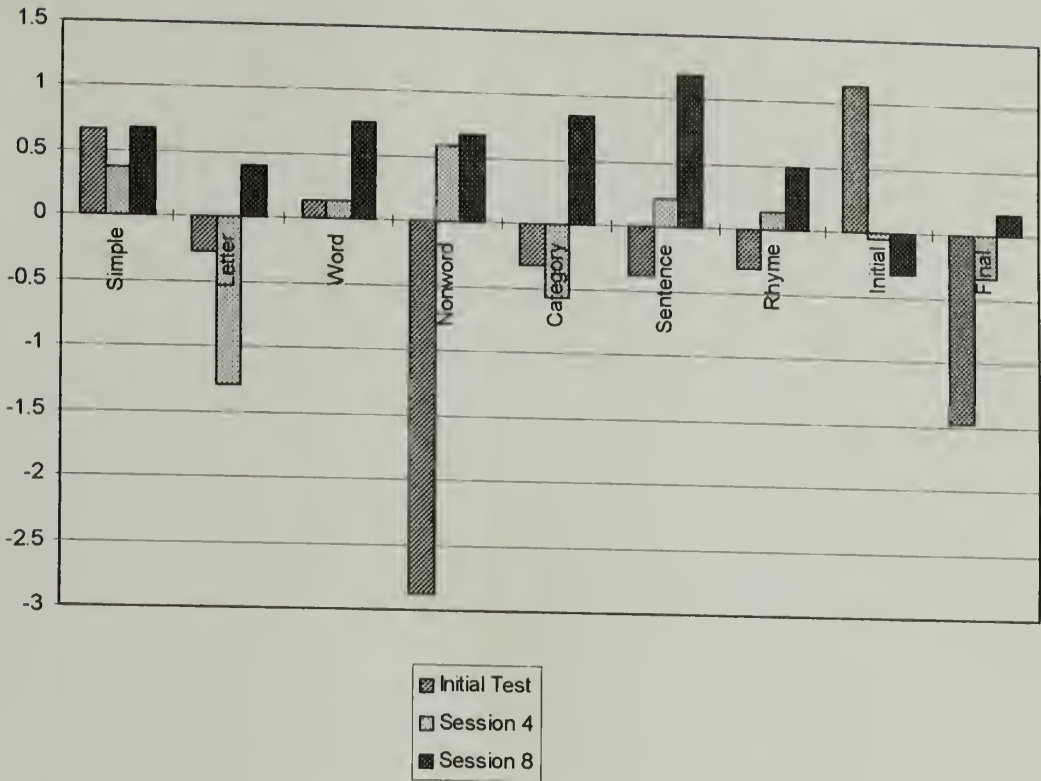
Reported in standard scores as defined against a normative
sample of college students.

Figure 8. Participant A's Performance on the CAAS Tasks
Presenting Unpracticed Material During Initial Testing and
at Sessions 4 and 8.

Table 3.   Breakdown of Accuracy and Response Time for
Participant A on Unpracticed CAAS Tasks During the Initial
Testing and Sessions 4 and 8.

	Initial Acc.	Initial RT	Sess. 4 Acc.	Sess. 4 RT	Sess. 8 Acc.	Sess. 8 RT
Simple Task	100.0	0.506	100.0	0.550	100.0	0.504
Letter Task	100.0	0.573	100.0	0.662	100.0	0.513
Word Task	100.0	0.878	97.4	0.865	100.0	0.602
Nonword Task	100.0	1.971	100.0	1.186	100.0	1.094
Categ. Task	95.5	2.049	91.7	2.124	100.0	1.471
Sent. Task	100.0	3.234	100.0	2.776	94.4	1.995
Rhyme Task	100.0	1.418	96.9	1.266	100.0	1.170
Initial Task	93.5	2.133	96.8	1.656	90.6	1.671
Final Task	90.3	2.544	100.0	2.031	96.8	1.743

Acc. Corresponds to accuracy, RT to response time.

The Reading Sample. On the first reading, A read at a rate of 141.4 words per minute, with 0.44 errors per 100 words read. On the second reading he achieved a speed of 178.4 words per minute and an error rate of 0.00 per 100.

The Inference Test. The first time that A took the inference test he answered eight of the sixteen questions correctly, which is exactly the chance level of achievement. On the second testing he answered fourteen out of the sixteen correctly, a substantial improvement.

Participant B

CAAS Performance on Abnormal Psychology Material. Participant B's changes in overall accuracies and response times on the three abnormal psychology CAAS tasks are given in Figure 9. The breakdown of his performance on the categories within the word task is given in Table 4.

In terms of accuracy, B looks as if he made progress in all of the tasks, although the progress is not terribly substantial in any but the sentence task. The response times, however, tell a different story. Here, he decreased notably in all of the tasks, with the least amount of gain in the category task.

When looking at the separate categories of the word task, the same cautions apply as did for Participant A.

Word Task

Accuracy
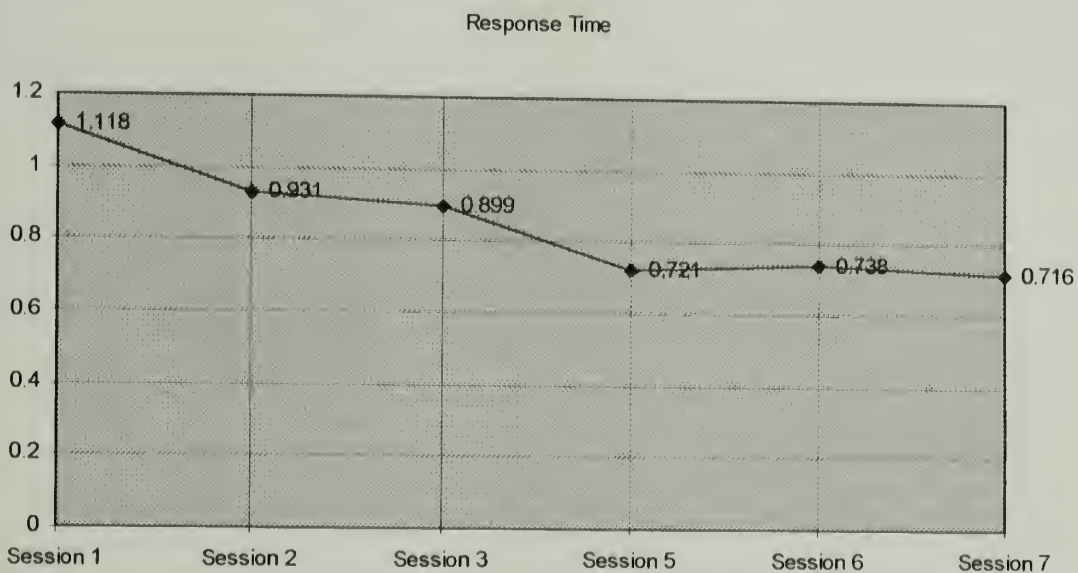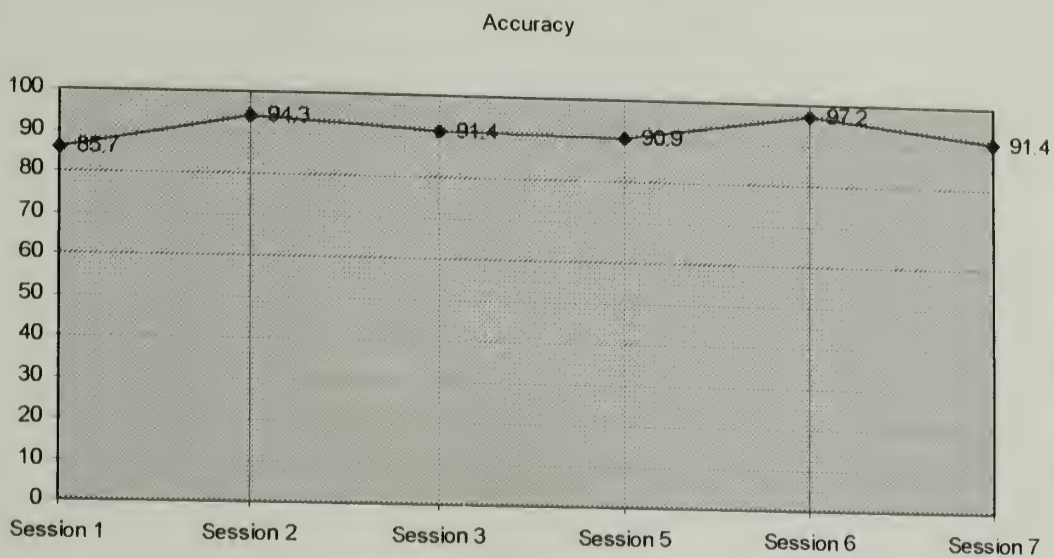
Response Time

Figure 9.   Participant B's Performance on Abnormal
Psychology CAAS Tasks.

Figure 9. Continued

Category Task
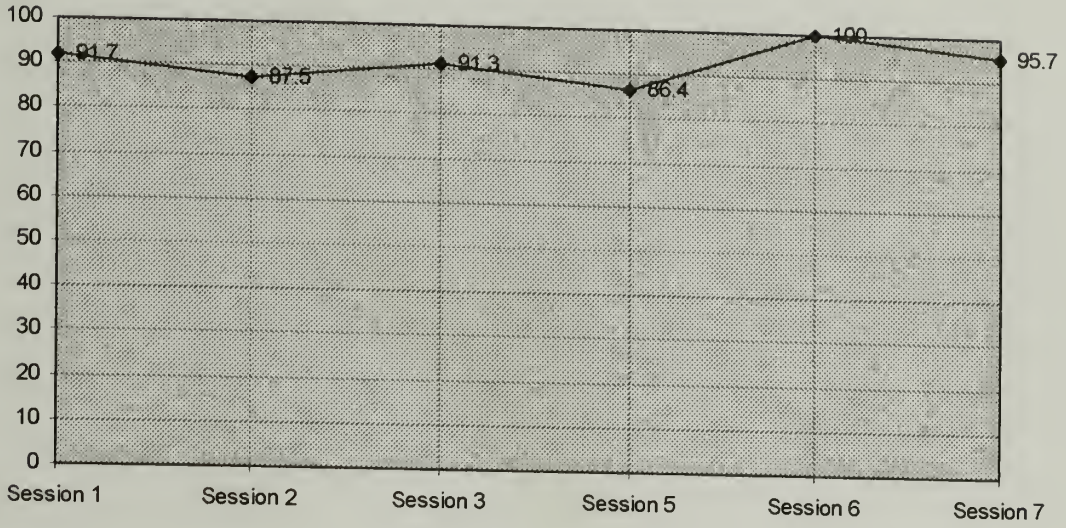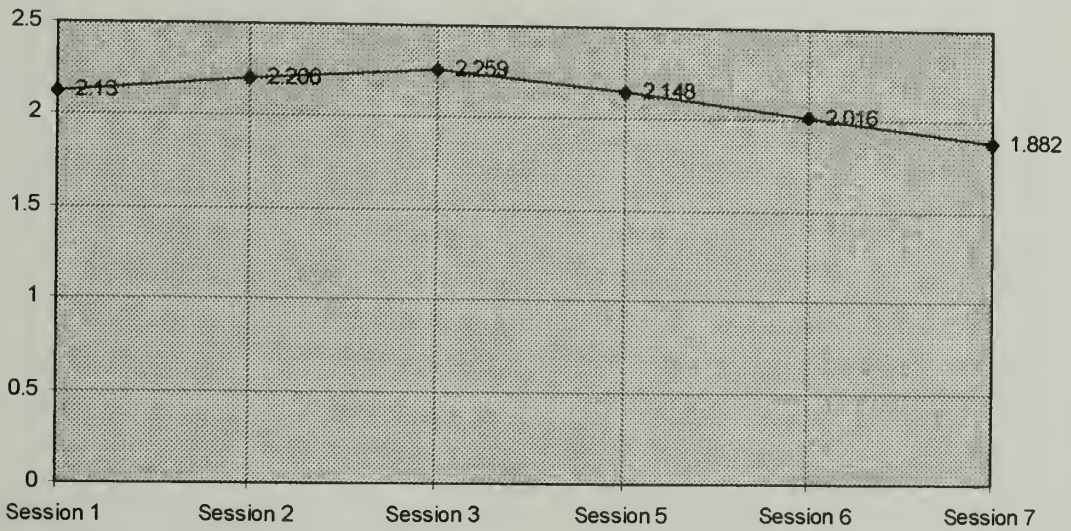
Accuracy

Response Time

Figure 9. Continued

Sentence Task

Accuracy
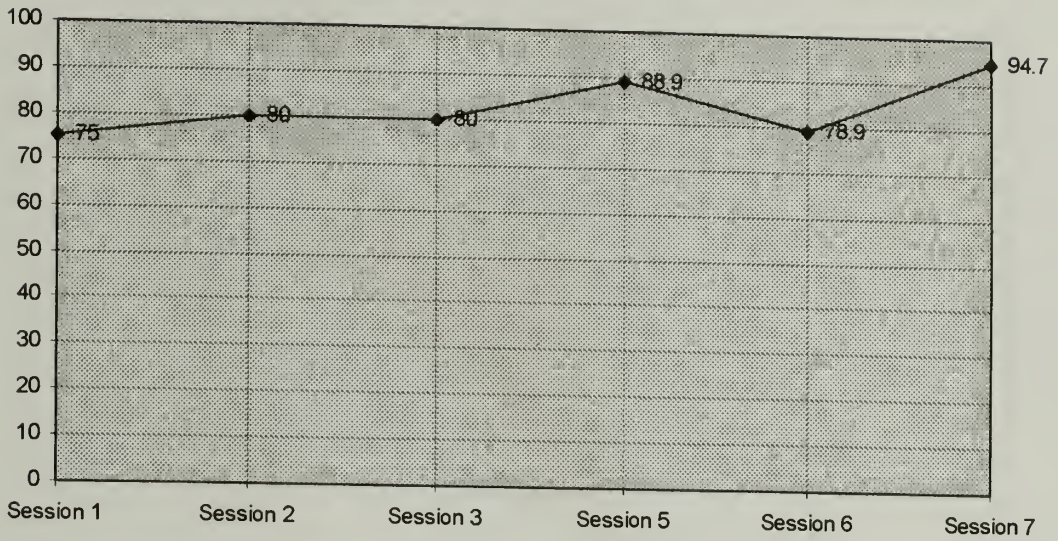
Response Time
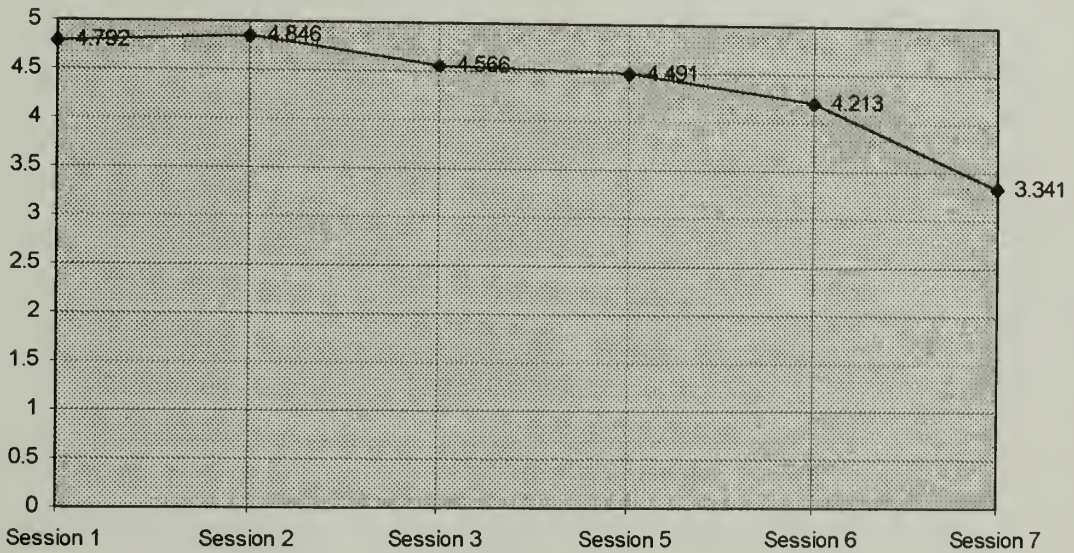
Table 4. Participant B's Performance Across Sessions on the
Categories Within the Abnormal Psychology Word Task

	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6
Sess. 1	83.3	100.0	83.3	83.3	100.0	66.7
	(1.038)	(1.098)	(1.049)	(0.986)	(1.130)	(1.653)
Sess. 2	100.0	100.0	100.0	100.0	83.3	83.3
	(0.933)	(0.843)	(0.880)	(0.962)	(0.951)	(1.005)
Sess. 3	83.3	100.0	100.0	100.0	83.3	83.3
	(1.185)	(0.844)	(0.854)	(0.949)	(0.829)	(0.930)
Sess. 5	100.0	100.0	100.0	75.0	83.3	66.7
	(0.717)	(0.682)	(0.675)	(0.723)	(0.849)	(0.805)
Sess. 6	100.0	100.0	83.3	100.0	100.0	100.0
	(0.667)	(0.836)	(0.715)	(0.724)	(0.573)	(0.915)
Sess. 7	100.0	100.0	100.0	100.0	100.0	50.0
	(0.780)	(0.629)	(0.702)	(0.897)	(0.641)	(0.842)

Sess. denotes the session number
Cat. denotes the category number
For each session, accuracies are the top number and
response times the bottom, in parentheses.

Still, substantial progress can be seen in terms of response times, although the accuracy data is, once again, less certain.

CAAS Performance on Unpracticed Material. Figure 10 shows the standard scores for B's performance on the unpracticed CAAS tasks during the initial testing session and at the fourth and eighth sessions of the intervention while Table 5 lists the accuracies and response times that correspond to these standard scores. As with A there is improvement on several of the tasks, namely the word, nonword, sentence, and, oddly enough, the letter task. There also may be improvement in the simple and final phoneme tasks, although the improvement is slight enough to think it might be due entirely to variability. There is a decrease in performance on the rhyme, initial phoneme and category tasks.

A note needs to be made at this point concerning B's performance on the category task. An interesting feature of the category task is that there are several words that can be from two different categories, for example "antagonist", which most people would expect to be a literature term but which a chemist would realize could also be a term used in science, denoting one of the chemical agents in a chemical reaction. There were other terms that worked in this fashion as well. B, being a chemist himself, recognized
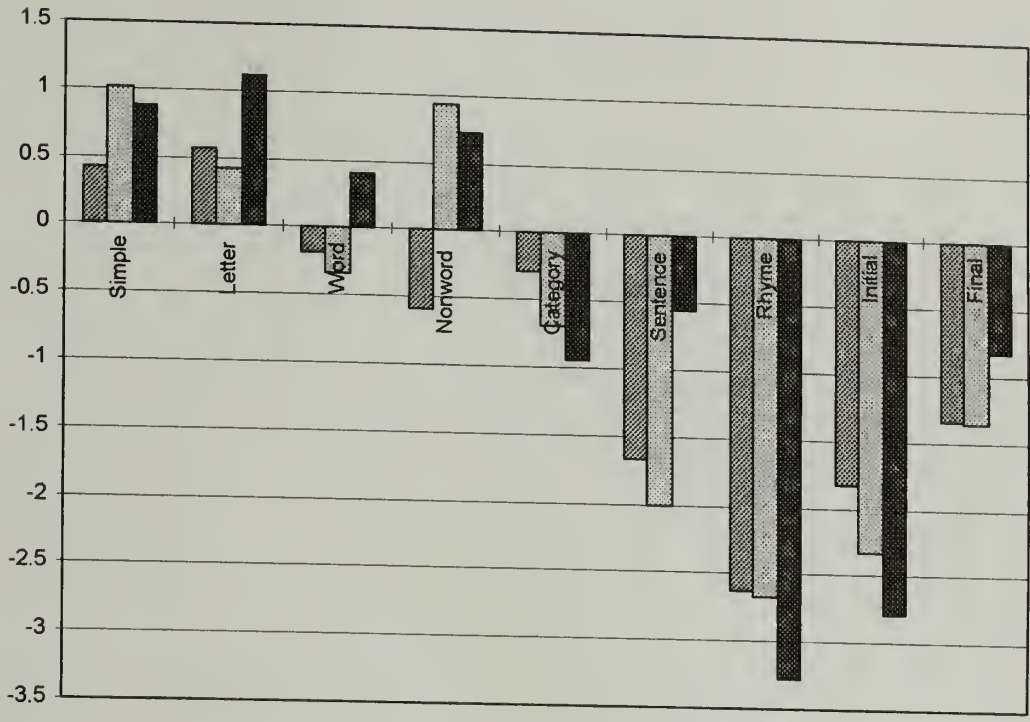
Reported in standard scores as defined against a normative sample of college students.

Figure 10. Participant B's Performance on the CAAS Tasks Presenting Unpracticed Material During Initial Testing and at Sessions 4 and 8.

Table 5. Breakdown of Accuracy and Response Time for Participant B on Unpracticed CAAS Tasks During the Initial Testing and Sessions 4 and 8.

	Initial Acc.	Initial RT	Sess. 4 Acc.	Sess. 4 RT	Sess. 8 Acc.	Sess. 8 RT
Simple Task	100.0	0.544	100.0	0.452	100.0	0.472
Letter Task	100.0	0.500	100.0	0.512	100.0	0.452
Word Task	84.6	0.672	84.6	0.770	92.1	0.646
Nonword Task	77.5	0.886	100.0	0.870	92.5	0.803
Categ. Task	91.7	1.977	91.3	2.179	87.5	2.231
Sent. Task	88.9	4.081	88.9	4.348	100.0	3.361
Rhyme Task	76.7	1.669	83.9	1.948	72.4	1.723
Initial Task	83.9	2.223	87.1	2.570	81.2	2.616
Final Task	87.1	2.393	79.3	2.102	93.3	2.236

Acc. Corresponds to accuracy, RT to response time.

such terms as being science terms and, when they were presented first of the pair of words he would respond that the category was "science" before reading the second word (which, in this case, was "plagiarism", a term much more obviously associated with literature). For unknown reasons, B answered in this fashion more often during later sessions than earlier sessions. It is very likely that this behavior hampered his performance in the category task.

Another important item to note is that B is not a native speaker of English, and often expressed difficulty with the phonological tasks in that he found it difficult to work out the sounds in his head. This is the most probable explanation as to why his performance on the three phonological tasks was so much lower than the performance on the other tasks, most notably the nonword task, where on would expect the largest amount of correlation.

The Reading Sample. On the first reading, B read at 110.4 words per minute with 3.21 errors per 100 words. At the time of the second reading he was able to read at 118.9 words per minute and had an error rate of 3.63 per 100.

The Inference Test. B performed very well on his first taking of the inference test, responding correctly to fourteen out of the sixteen statements. On the second taking of the task, he scored identically, even going so far as to be incorrect on the same to statements (one of which

had been modified from its original framework). It seems as though he understood the passage very well both times, and responded to the two questions incorrectly due to his lack of outside knowledge in the field.

Participant C

CAAS Performance on the Abnormal Psychology Material. Participant C's performance on the three abnormal psychology CAAS measures is provided on Figure 11 while the breakdown of her performance across the categories of the word task is shown on Table 6.

In general, C's accuracies on the word and sentence task tend to improve over the course of the intervention (although the sentence accuracy seems to stagnate until the very end), while her category accuracy seems to have hit what amounts to a ceiling effect from the very beginning. Her response times fall on both the category and sentence task, but the word task is another story. Here her response times rise fairly steadily until the fifth session, where they fall a bit, but never reach the speed of the first session. It is clear that there is some trade-off going on between accuracy and response time, which was evidenced in a change in strategy that was very noticeable upon watching her perform. In the beginning she would attempt to answer

Word Task

Accuracy
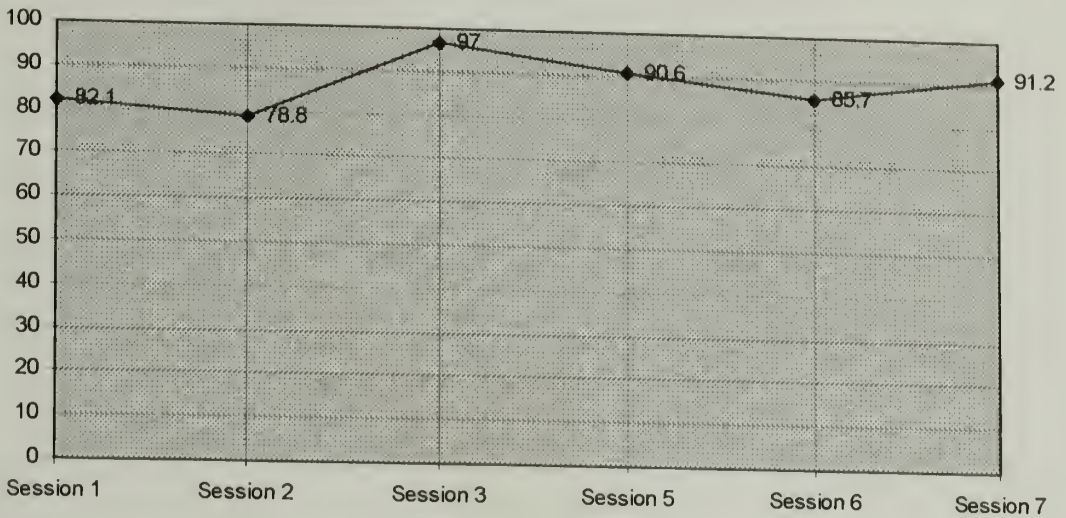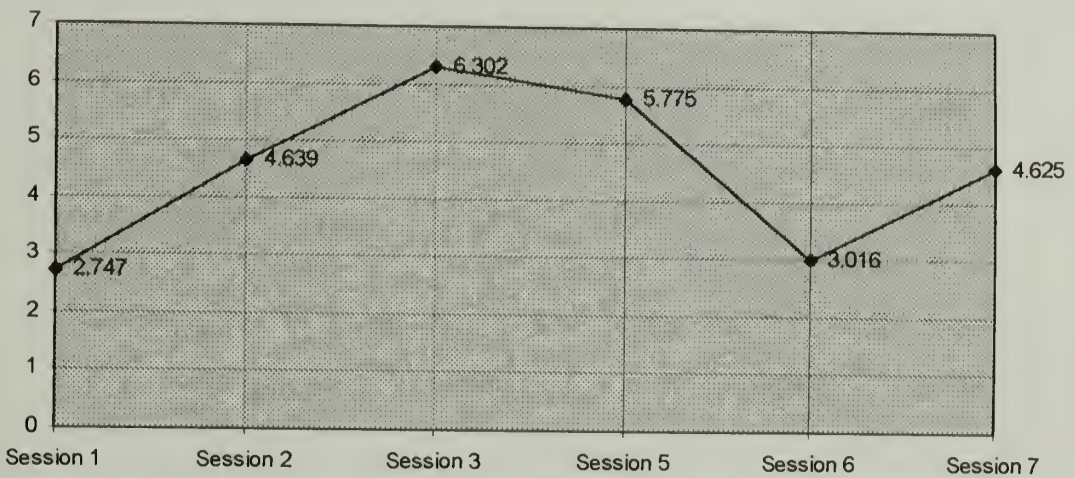
Response Time

Figure 11.   Participant C's Performance on Abnormal
Psychology CAAS Tasks.

Figure 11.   Continued

Category Task
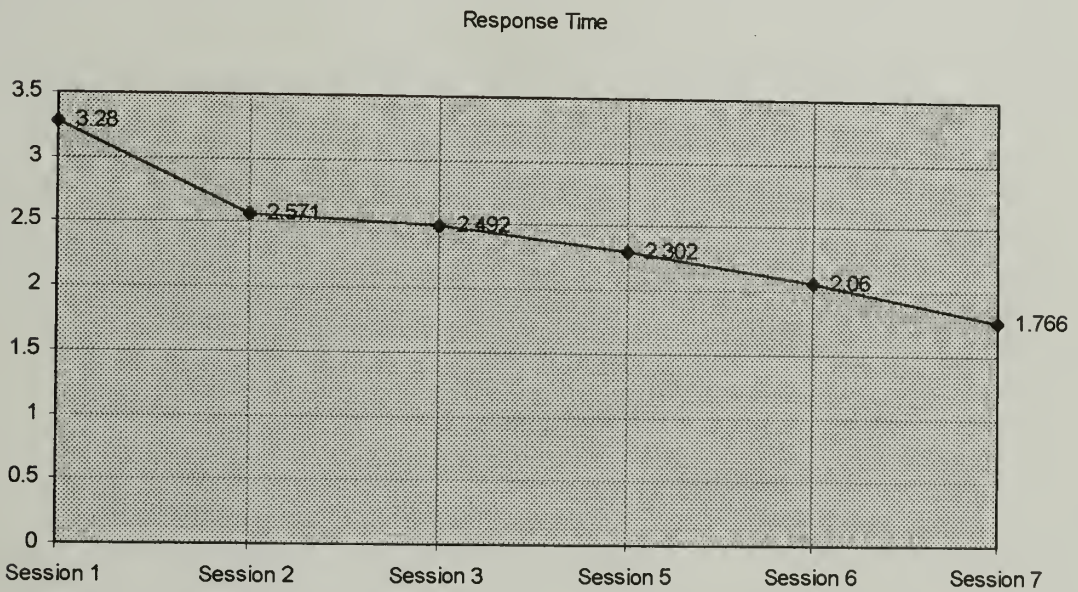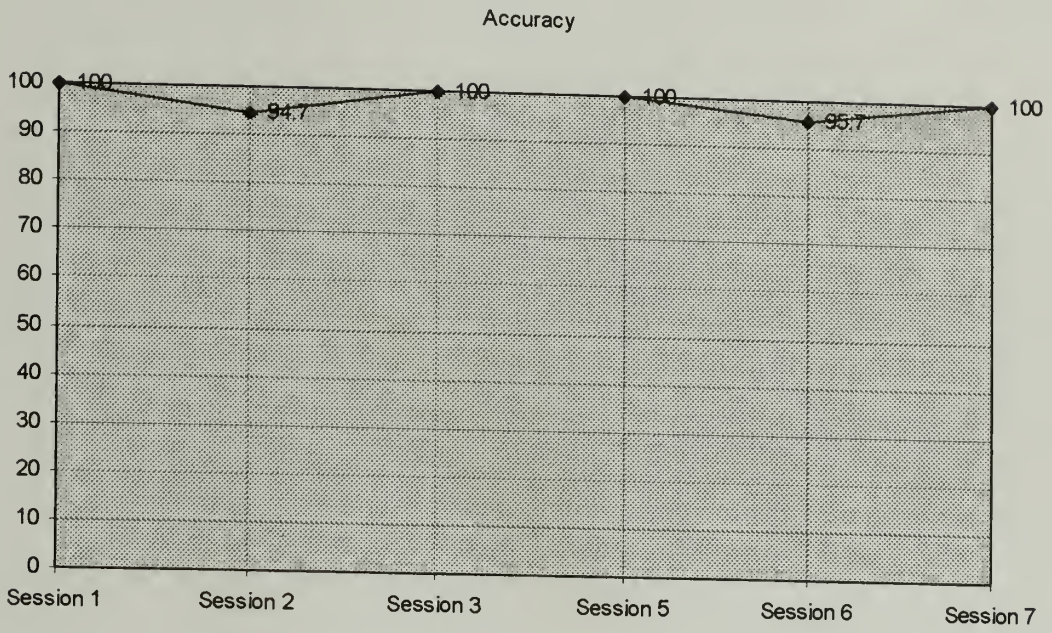
Accuracy

Response Time

Figure 11. Continued

Sentence Task

Accuracy
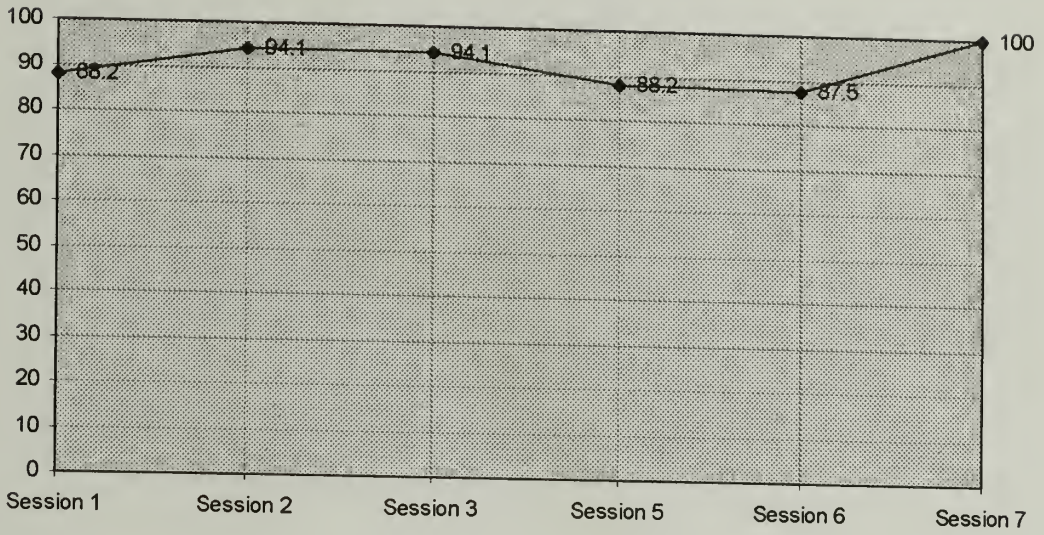
Response Time
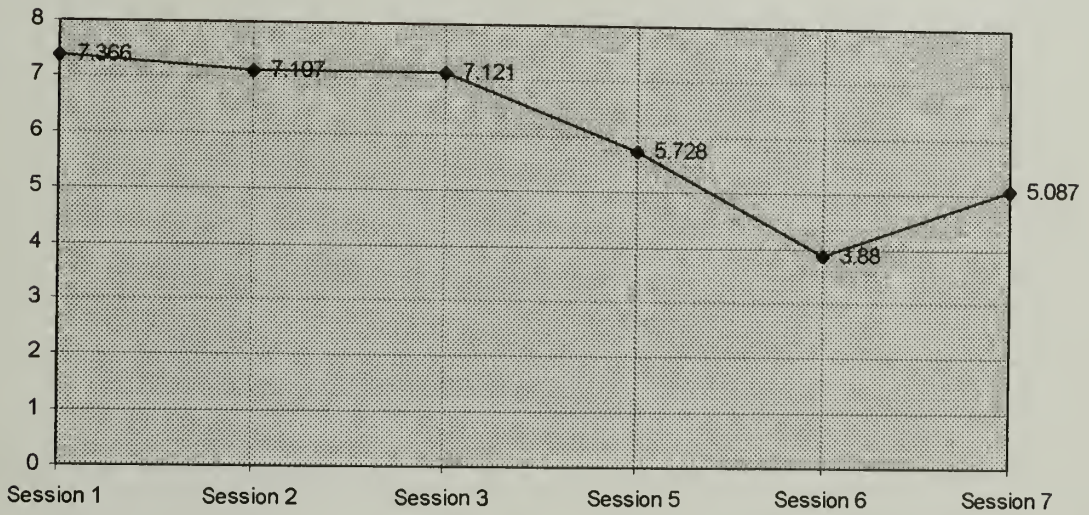
Table 6. Participant C's Performance Across Sessions on the Categories Within the Abnormal Psychology Word Task

	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6
Sess. 1	60.0 (2.380)	100.0 (2.453)	100.0 (3.312)	75.0 (1.532)	100.0 (3.894)	50.0 (5.276)
Sess. 2	66.7 (2.332)	100.0 (3.171)	60.0 (6.309)	50.0 (7.814)	83.3 (5.477)	100.0 (4.065)
Sess. 3	100.0 (3.566)	100.0 (2.722)	100.0 (6.683)	100.0 (6.748)	100.0 (6.040)	80.0 (12.73)
Sess. 5	100.0 (5.202)	83.3 (8.384)	100.0 (3.840)	100.0 (3.346)	83.3 (5.759)	*** (***)
Sess. 6	100.0 (2.919)	83.3 (4.017)	100.0 (0.899)	66.7 (2.556)	83.3 (3.711)	66.7 (6.592)
Sess. 7	66.7 (7.143)	100.0 (1.598)	100.0 (2.255)	100.0 (7.386)	100.0 (2.647)	83.3 (9.329)

Sess. denotes the session number

Cat. denotes the category number

For each session, accuracies are the top number and response times the bottom, in parentheses.

*** - The computer was unable to record the scores for this category, probably because it took C so long to respond to at least one of the items that the program would not calculate an average.

quickly and correctly, but as time passed she became more
focused on accuracy, to the point where she would sound out
words multiple times to herself (evidenced by lip movements,
etc.) before answering. At the fifth week she was asked to
try to go faster and not worry about accuracy as much, with
the corresponding effect on her performance, but she was
still sounding out much more frequently than in the
beginning.

The pattern can be seen more clearly in Table 6, where
there is an astonishing amount of variability in response
time between the different categories and across sessions
(in fact, the standard deviation of the response times
reached, on occasion, a height of more than 6 seconds).
This is because the response time is highly dependent on the
proportion of words that C knew off the top of her head
(which is not indicated by accuracy, as she reasonably
accurate at sounding words out that she did not know), for
when she did not know a word she would agonize over it to
get the pronunciation correct. This issue will come up
again.

CAAS Performance on Unpracticed Material. The standard
scores for C's performance on the CAAS tasks for the initial
test and the fourth and eighth sessions are presented on
Figure 12, while the accuracies and response times can be
found on Table 7. She increased on the nonword, sentence,
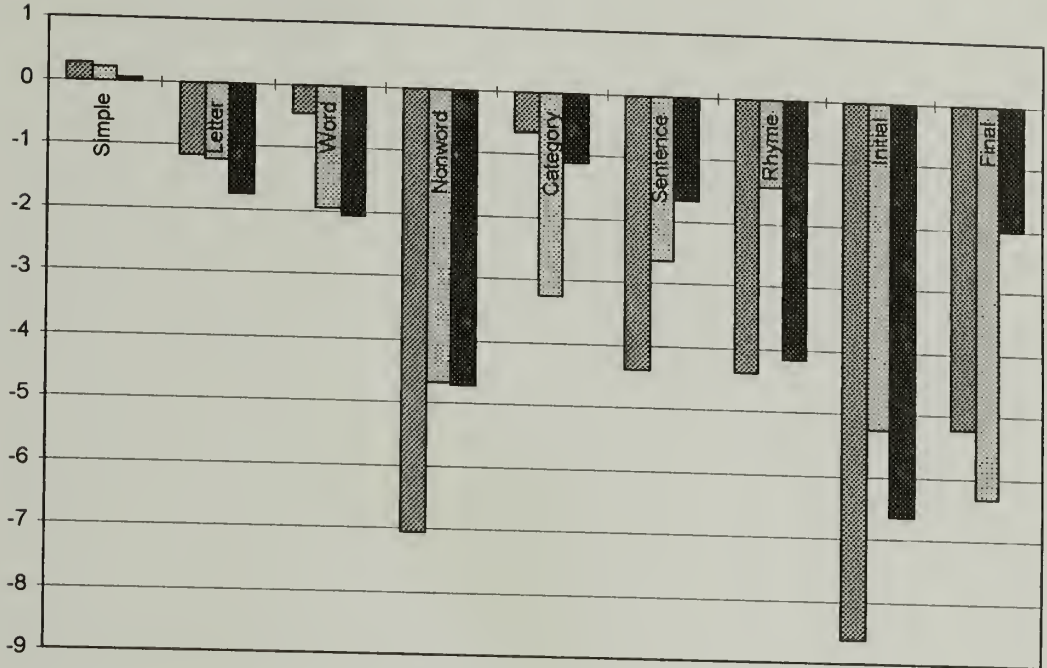
Reported in standard scores as defined against a normative sample of college students.

Figure 12. Participant C's Performance on the CAAS Tasks Presenting Unpracticed Material During Initial Testing and at Sessions 4 and 8.

Table 7. Breakdown of Accuracy and Response Time for Participant C on Unpracticed CAAS Tasks During the Initial Testing and Sessions 4 and 8.

	Initial Acc.	Initial RT	Sess. 4 Acc.	Sess. 4 RT	Sess. 8 Acc.	Sess. 8 RT
Simple Task	100.0	0.564	100.0	0.574	100.0	0.601
Letter Task	100.0	0.650	100.0	0.656	100.0	0.703
Word Task	97.0	1.145	97.2	1.814	91.7	1.824
Nonword Task	84.4	7.939	94.6	5.894	97.2	5.946
Categ. Task	95.0	2.209	91.7	3.527	90.9	2.406
Sent. Task	86.7	6.366	100.0	4.944	100.0	4.197
Rhyme Task	89.7	2.638	93.5	1.726	93.3	2.605
Initial Task	78.6	5.410	86.2	3.959	93.1	4.686
Final Task	92.9	4.599	90.3	5.159	100.0	2.924

Acc. Corresponds to accuracy, RT to response time.

initial phoneme and final phoneme tasks, most especially the nonword and sentence, was oddly up and down on the category and rhyme tasks (with a general lessening of performance on the latter), changed little in the simple and letter tasks and decreased in the word task.

As can be seen on Table 7, the decrease in performance on the word task has an increase in response time as its primary component, with an additional loss of accuracy affecting the final session of the intervention. This response time increase is also a product of the strategy change mentioned earlier. One would have expected to see a similar pattern in the nonwords, but it seems that the response time was already so long (over seven seconds during the initial testing) that she was already using a similar strategy to the one she switched to over the course of the word task.

The Reading Sample. For the first reading sample, C read at 105.1 words per minute and had an error rate of 3.45 per 100 words read. At the second reading she achieved 120.0 words per minute and an error rate of 1.06 per 100.

The Inference Test. C scored twelve out of the sixteen items correctly on the first taking of the test and ten on the second. There was no apparent pattern of answering to explain this drop in performance.

CAAS Tasks

For each of the three sessions during which the presented CAAS tasks were unrelated to the textbook material that the participants were practicing the standard scores for the participants' performances were computed. They were then combined for the purposes of running an analysis to determine if any significant progress had been made in any of the tasks. This was computed by running a series of simple, one-tailed (since the only real concern was whether the participants improved or not) t-tests on these standard scores, comparing scores at the initial testing with both sessions four and eight, and also comparing sessions four and eight with each other. The results of these tests are displayed on Table 8.

Since there are only two degrees of freedom in the design, it takes a great deal of improvement to achieve significance. As can be seen, this level of improvement was obtained in both the sentence task and the nonword task, while insignificant improvement was found for the other tasks save the word task, which showed insignificant lessening of performance. It is clear the strategy change

Table 8. Results of T-tests Comparing Standard Score
Performance During the Initial Assessment and Sessions 4 and
8 of the Intervention

	Init. Assess vs. Sess. 4	Sess. 4 vs. Sess. 8	Init. Assess vs. Sess. 8
Simple Task	-0.31 (0.393)	0.01 (0.505)	-0.39 (0.368)
Letter Task	1.33 (0.843)	-0.95 (0.221)	-0.51 (0.330)
Word Task	1.15 (0.814)	-1.55 (0.131)	0.18 (0.562)
Nonword Task	-3.63 (0.034)*	0.54 (0.679)	-3.74 (0.033)*
Category Task	1.42 (0.854)	-1.56 (0.130)	-0.02 (0.492)
Sentence Task	-1.11 (0.192)	-7.13 (0.010)*	-3.73 (0.033)*
Rhyme Task	-1.20 (0.176)	1.10 (0.806)	-0.29 (0.400)
Initial Phoneme Task	-1.19 (0.179)	2.07 (0.913)	-0.73 (0.272)
Final Phoneme Task	-0.02 (0.493)	-1.42 (0.146)	-2.31 (0.074)

The result of the t-test is given as the top number,
while the second number, found below, is the p value for the
one-tailed test. An * after the p-value indicates
significance at the 0.05 level. All tests have 2 degrees of
freedom. Negative values for the t-test indicate general
improvement, while positive values indicate lessened
performance.

evidenced by Participant C on the word task is the major contributing factor to the overall lessening of performance on the word task, since the other two participants improved in their performance. The effect of B's difficulty with the category task on the overall results for that task is present, but probably not as substantial.

Reading Samples

The average reading speed was 119.0 words per minute for the first sample and 139.1 for the second. A one-tailed t-test at two degrees of freedom gave a result of -2.33, giving results that were not significant ($p = 0.073$).

The average number of errors per 100 words was 2.37 for the first reading and 1.56 for the second, giving a t-test (one-tailed, two degrees of freedom) result of -0.97, a result that was not significant ($p = 0.218$).

Inference Tests

The scores on the inference tests were combined, giving an average of 70.83% correct on the first administration and 79.17% on the second. A one-tailed t-test (with two degrees of freedom) run on the results gave a value of -0.55, with a

p of 0.318, indicating that there was no significant overall improvement across participants on this test.

CHAPTER IV

DISCUSSION

Trends and Analyses

When looking at the results, it is important to bear
two things in mind. First off, each of the t-tests was
performed using two degrees of freedom. This means that a
large absolute difference must be present in order to
achieve significance, a much larger difference than would be
needed with an even slightly greater number of participants.
Also, the individual results for any one of the participants
have a huge effect on the results, which and can swing the
overall test results from significance to insignificance
(and vice versa) very easily. For this reason the small
number of significant test results is not surprising, and
actually says very little about the effectiveness of the
intervention. The second factor to keep in mind is the
sheer number of t-tests performed in this study. The
likelihood of achieving results of significance when there
is in fact no significance present is 5%. There are 30 t-
tests in this study, and it would be expected that one or
two of them would show significance even if there were, in
actuality, no effect. Because of these two factors, only

very limited conclusions can be made from the t-test results presented above.

There are, however, trends in the data, some indicated by the significant test results, that bear some looking at, and some explanation. These will be examined in the next few sections.

The Practiced Material: CAAS Results

No formal analyses were performed on these results as it was felt that the information would not be very helpful in terms of supplying important information. With only three participants, any significance would be hard to find through statistical tests, and would be difficult to support in any case.

Overall, however, it does appear that the home practicing was effecting the participants' performance on the CAAS tasks related to the material that they were practicing at home, both in terms of accuracy and response time. This should not be surprising, for all it means is that the participants are becoming faster and more accurate at identifying the words that they are practicing. It would be much more surprising if there were no improvement in these tasks.

One thing to keep in mind when analyzing this tasks versus the other, unpracticed tasks, is that a significant amount of improvement in the practiced tasks could be a function of memorization of individual items, especially in the category and sentence tasks, in which the number of items is much more restricted than in the word task. This is part of the reason why analyses were not run on the tests of the practiced material. This is not the case with the unpracticed material. These tasks sample from a wide range of items, which are seen only once a month for a brief period of time each. If anything, one would expect that the sessions using the tasks for the practiced material would interfere with memory for the material contained in the unpracticed tasks, making memorization less likely. This is part of the reason that the tests for the practiced materials were included in the experiment (the other was to demonstrate that participants were improving on practiced materials).

The Simple Response Time and Letter Tasks

Neither the simple response time task nor the letter task showed a noticeable degree of improvement, as evidenced by the t-test results. This is, in fact, a heartening finding. If there were significant improvement in these

tasks, which are very basic and would almost definitely (especially in the case of the simple task) not be effected by the practice in reciting words, it would be necessary to be very wary when looking at other CAAS improvements, since improvement on these tasks would indicate an improvement in overall reaction time (perhaps due to familiarity with the task) rather than an improvement in reading. A case could be made that letter identification speed could improve through practice on word lists, but this is considered to be unlikely, seeing as the participants are college students and have been reading (with varying degrees of success) for several years.

The observation that there does not seem to be a substantial amount of improvement on these tasks, therefore, seems to indicate that any improvements on the other CAAS tasks are due to improvements in the skills being measured rather than in increases in the participants' ability to respond to the computer stimuli in general.

The Unpracticed Word Task

There were no overall improvements in this task, either significant or otherwise (the average standard score was lower for the eighth session than the initial assessment). This is disappointing because if, in fact, there are

transfer effects from the word list practicing it would be expected that they would manifest themselves here. The fact that they did not, however, is due entirely to C's performance on the task. Although A and B may not have made enough improvement to count as significant without her data (a possibility that was not tested, since a t-test with one degree of freedom is almost ludicrous), C's performance is responsible for the overall decrease in the performance.

The reason for C's lessening of performance has already been explained previously, namely that she changed strategies when responding to presented items, taking a great deal more time to answer those items that she did not recognize than she had previously. It is believed that this behavior was due to anxiety about answering items incorrectly. Whatever the reason, the strategy change made it impossible to tell whether she was actually able to recognize words faster, on average, using this test. Since the decrease in her performance was more substantial than the increases in A and B's performances, this strategy shift became the most substantial part of the word task results.

The Nonword Task

Along with the word task, it would be expected that the direct effects of an improvement in word recognition ability

would be manifested in performance on this task. In fact, this task would be expected to be an even more crucial measure of word recognition improvement. This is because there are many irregular words in the word task, some of which would need to be memorized specifically in order to be pronounced correctly, while the bulk of the nonwords can be pronounced through the application of phonetic rules. As the expectation was that the intervention would provide the participant with chunks of words that he or she had memorized, and that these memorized chunks could be used to assemble other words that had not been memorized more quickly, the effects would be expected to be more profound in the nonword task.

In fact, the effects on the nonword task were shown to be quite substantial, enough so that the t-test registered a significant level of improvement, at least between the initial testing and the fourth session, and overall, across the sessions. This is regarded as being indicative of a true improvement on the task, and is seen as furthering the hypothesis presented herein. The intervention does seem to have the effect of improving performance on the pronunciation of previously unknown words.

The Unpracticed Category Task

There was no substantial improvement on the category task, and this was not that surprising either. Performance on the category task is strongly influenced by knowledge of the subjects being presented, which would not be expected to increase through the course of the intervention. In fact, B's performance decreased because he responded in a way that indicated that the increase of knowledge that he was acquiring through his chemistry classes may actually have hindered him in the knowledge-based portion of the task.

Still, one would expect that a small degree of improvement would manifest itself in this task since an increase in word recognition speed should apply to at least some of the words in this task, which should speed up response time to at least a small degree. It would not be expected, however, that that this increase would be of a sufficiently high magnitude to be picked up with t-tests using only two degrees of freedom.

The Sentence Task

A greater amount of improvement would be expected on the sentence task than on other tasks given an improvement in word recognition performance for the sheer reason that

there are far more words to be read in this task than in any of the other tasks. If an improvement was made in word recognition speed, it would be expected to have a greater impact when there are many words than when there are only a couple, or even just one. It may be granted that many of the words in a given sentence are high frequency words which the participants would already know and have encapsulated, but enough would not be over the course of the task to allow increased ability to manifest itself more profoundly.

The results of the study show that this is exactly what appears to have occurred. The gains in the sentence task, especially in the last four sessions, registered as being highly significant, which is indicative of a substantial improvement. The results of the sentence task, therefore, support the idea of a generalized gain in word recognition speed and ability.

The Phonological Tasks

Although the final phoneme task seemed to show a decent amount of improvement (to the point where the t-test almost, but not quite, registered a level of significance), it is difficult to say whether there was any real improvement on any of these tasks, since performance was so incredibly variable. One would expect that an increase in phonological

awareness would apply to all of the tasks, and not favor any one over the others, which leads to the conclusion that there was, in all probability, no true increase in phonological ability.

As far as expectations are concerned, these results are what was expected, although the possibility that there might have been some improvement in phonological ability was not. The intervention was expected to improve word recognition ability, but to do so without using phonological processing skills. There is some possibility that an increase in decoding skill could speed up the ability to respond to these items, but it is anticipated that this effect would be small, since the items are supposedly well-known to the participants and the major focus of the task is to compare the sounds found in each word.

If, over the course of the intervention, phonological skills were to improve, it would probably be due to a process in reverse of the normally accepted method of training phonological awareness. Although the results seem to indicate that there may be trends in this direction, it is very probable that these are due more to variability than anything else, and more investigation needs to be done before any further speculation is warranted.

The Reading Sample

All three participants did increase in terms of their reading speed across the course of the intervention, but the results were not substantial enough to elicit a significant t-test result, although it was very close. It is felt that the improvements in reading speed are probably real improvements, considering the CAAS evidence, and that the lack of significance is due to statistical limitations.

In addition, there was an overall decrease in errors, but the t-test results were even less significant. It cannot be assumed that this is a real improvement in performance without the presence of more data.

The increase in reading speed is what would be predicted, given the nature of the intervention, and leads more evidence towards it being effective. The amount of improvement on the test would be expected to be a function of the concentration in words unknown to the participant within the passage and of the care taken in reading each individual word (many errors involved the skipping of connecting words such as "of" and "the"), and thus would be expected to have a great deal of variability, such that significant improvements would not be expected with this number of subjects.

The Inference Test

An increase on the inference test would have indicated that the participants were not only becoming better at word recognition, but that this was allowing them to comprehend the material better. There were several factors that could have compounded the analysis, however. For one thing, the participants were also reading through their textbooks and going to class, so their knowledge of the material should have improved, allowing them to perform better on the task. For another, if they were very accurate the first time (as in the case of B, whose errors seemed to be based on assumptions about the subject rather than a lack of understanding of the passage) they would not be expected to improve, regardless of the gains in overall reading ability. Also, they could remember some of the questions from before, and answer incorrectly the second time as they did not catch that the question had been altered.

Because of these factors it is very difficult to say what the results of the test mean, but the lack of any substantial overall difference between the administrations of the test makes trying to do so inconsequential.

Conclusions

Overall, it did appear that the intervention was effective, and that it worked the way in which it was expected to work. The adult participants seemed to show the same patterns of performance (given the individual quirks among the participants) that the children in Royer's (1997) and Rath et al.'s (1998) data did, which is very encouraging.

Another point to note is that the participants were more advanced than the average adult dyslexic, as evidenced by their presence in a fairly competitive university. Indeed, A was the most advanced of the three in terms of reading ability, and he improved the most on the measures. It stands to reason that if the results with individuals who have already developed compensatory strategies are this good that results with more disabled individuals might be even better. Again, this indicates that there is a strong possibility that the intervention would be successful across the age group.

Practical Implications

The practical implications of the finding that this intervention works (or at least strongly appears to) are

fairly straight-forward. It has been demonstrated that there is, in fact, an intervention available for college-level students that not only appears to help them read more effectively in their specific classes (for their performance did improve on the class-related material as a function of the intervention) but should also be able to help them become better overall readers, a claim which none of the other commonly used interventions can make.

The methodology for setting up the intervention is simple, and can be implemented by the student him- or herself, thus making it very inexpensive. All they need to do is to compose a list of words relevant to the topic which they are studying (preferably before the course begins) and turn this into a series of word lists. These words can be practiced every night, first for speed of identification and pronunciation, and later for recall of meaning. At an average of less than ten minutes a night per subject (participant A spent about five minutes a night on his slowest nights) this is hardly a burden. If this is done before the class it would give the student a significant advantage when the class begins, and even if it is performed during the course of the class it could be a tremendous help. The only outside help that is necessary is training (which should not be very difficult) and the recording of a

tape with the proper pronunciation of the words so that the student has a reference point from which to begin.

It is granted that this intervention probably should not be used in isolation for most dyslexic students, but it is certainly a very cost-effective addition to a current intervention program. In fact, it is the kind of intervention that should be beneficial for both individuals that are definitely dyslexic and those whose status is less well-defined, save that they have a difficulty in reading words. The evidence collected using children (Rath et al., 1998) supports this conclusion, and the intervention may be a feasible way of meeting the needs of students who believe they have a reading problem but do not have the resources to be diagnosed and continue with a support program—after all, it is, in essence, just another way of studying for the class in question. In fact, it is fairly certain that this method would be effective for just about anyone who is having difficulty in a class, especially the part where the meanings of words are practiced and memorized.

Another case in which this intervention could be very useful is in the learning of another language, where the phonology is probably different from the individual's native language. The method would not only improve the student's pronunciation, but also his or her speed of word recognition, and thereby the overall reading speed, and his

or her knowledge of the vocabulary in the language. This application would be appropriate for all learners of a new language.

In conclusion, I believe that this intervention can, and probably should, be implemented as an option for students who have difficulty in reading. The implementation would involve an initial course which teaches the students how to perform the intervention (which should not take more than an hour or two) and some initial guidance, including taping the correct pronunciation of the word list for reference. The burdens on the part of the support staff should be minimal compared to the potential benefits to the individuals.

It is important to note, however, that it is unlikely that this intervention could be used to "cure" individuals with dyslexia. It should be able to increase their reading ability, but it may be impossible to raise this ability to the level of their nondisabled peers, especially in individuals who are severely disabled. But any improvement is a substantial step in the direction of opening up opportunities for these individuals and is worth the time involved.

Theoretical Implications

It appears that, indeed, participants did become better at recognizing and pronouncing words and nonwords, without the help of any phonological training. Because of this there is no reason to believe that the participants were somehow becoming better at phonological decoding; it makes more sense to hypothesize that they were actually recognizing words or word parts and were thus able to respond to them more quickly. Since an improvement in performance was demonstrated on nonwords, which certainly were not being practiced, it is clear that they were not recognizing the entire stimulus and thereby regurgitating it from memory. It seems more reasonable that they were recognizing bits of the words and nonwords, and that, through practicing with a large variety of words, they knew how to pronounce those bits, and could thus piece the word together, without phonetic word decomposition.

The implication of this finding is that it may, in fact, be possible to train people to do this and thereby allow them to bypass a reading problem, at least to some extent. Perhaps, if interventions such as this are performed at an early enough age, the reading problems could be eradicated entirely, something which is unrealistic to expect when any intervention is applied to adults. This is

a very heartening find indeed, and the implications in education are far-reaching: it may be possible to bring nearly everyone to a point where they can read, and at a level where it is not a burden but a tool.

Final Notes

The presence of only three participants in this study stands as a real criticism to the applicability of the results. It is felt, however, that the evidence provided in the child studies of Royer (1997) and Rath et al. (1998) backs up the evidence enough to conclude that, in fact, the effects that are being claimed are, in fact, present.

Further study is necessary in order to determine if the intervention has any effect on participants' phonological abilities, something which was hinted at but not conclusively demonstrated in this study. The theoretical implications of that finding would be very interesting indeed. It would also be interesting to see if an effect could be measured on the inference test with more experimentation, which would demonstrate conclusively that an increase in word recognition ability leads to a corresponding increase in reading comprehension.

The conclusions that could be made from this study are, however, very important in and of themselves. It has been

demonstrated that an effective and cost-efficient intervention can be produced that appears to help college-level students learn to read better. It has also been demonstrated that this process most likely is achieved without using phonetic decoding skills, which are thought to be dyslexics' specific problem. These findings could have far-reaching consequences for dyslexics, both in and outside of college, and could substantially improve their educational experience.

APPENDIX A

SAMPLE SVT PASSAGE WITH TEST SENTENCES

Sample Passage:

<u>Mrs. Elizabeth: A Memoir</u> was written by Elizabeth Anderson with help from Gerald R. Kelley. Mrs. Anderson, now eighty-four, was Sherwood Anderson's third wife. She met him in New York (where she was managing the Doubleday Doran bookstore) and lived with him in New Orleans, Paris, and rural Virginia until 1929. At that time, he sent her to visit her parents and then wrote her a one-line letter which stated: "I just wish you would not come back." Mrs. Anderson then moved to Mexico, renewed a friendship with William Spratling, whom she had known in New Orleans, and opened what became a successful dress shop. Her book ends with Spratling's death in an automobile accident in 1967, of which she comments: "I miss Bill Spratling so very much more than I ever missed Sherwood Anderson." It is a curious book, bland in describing her early years, dutiful and matter-of-fact about the Anderson years, and chatty about the Mexican years that followed. The writing is clearly that of Mr. Kelley, a professional journalist. But Mrs. Anderson's observations on her celebrated friends are just as clearly her own. "Others might eat an apple, Sherwood experienced it," she says. She also made such comments as "Edna St. Vincent Millay always had a coterie of followers but did not care about them one way or the other." Or, as she would observe of Bill Faulkner, "His studied courtesies and Southern mannerisms were a pose."

Sample Test Sentences:

Original: <u>Mrs. Elizabeth: A Memoir</u> was written by
               Elizabeth Anderson with help from Gerald R.
               Kelley.

Paraphrase: The eighty-four year old Mrs. Anderson was
               the third woman to marry Sherwood Anderson.

| Meaning Change: | She met him in New Orleans (where she was managing the Doubleday Doran bookstore) and lived with him in New York, Rome, and rural Pennsylvania until 1929. |
| Distracter: | For Elizabeth Anderson, <u>Mrs. Elizabeth: A Memoir</u> was her first book. |

Note: this example first appeared in Cicero (1995).

APPENDIX B

FORMULATION OF COMBINED SCORES

The formulae for finding combined scores for any of the CAAS tasks are basically identical, save that different values are used for the standard deviations acquired from the normative sample. In the formula below, "accsd" stands for the standard deviation of the accuracy in the normative sample and "rtsd" for the standard deviation of the response time of that group. "Acc" corresponds to the accuracy that the individual has achieved, and "rt" to the response time. All accuracies are recorded in terms of percent correct, and response times in the average number of seconds taken to respond to a single item.

The combined score, then, can be determined through the following set of calculations:

$$\text{Combined Score} = \sqrt{([100-acc] \div accsd)^2 + (rt \div rtsd)^2}$$

Standard scores are then calculated using the mean and standard deviation of the combined scores as found in the normative sample.

APPENDIX C

SAMPLE WORD LIST

Abnormal Psychology Words List #1 - Page 1

hysterical neurosis	asylum	polygenic	voyeurism
psychosis	behavioral medicine	traumatic experience	pituitary gland
Tay-Sachs disease	conversion disorder	contiguity management	frotteur
sexual impulsivity	executive functioning	consequences	neurometrics
axon	galvanic skin response	conduct disorder	neutrality
anxiety	prevalence	self-actualization	central nervous system
anoxia	Creutzfeldt-Jakob disease	Rett's disorder	inhibitory synapse
Down syndrome	attributions	genotype	catatonia
in vivo exposure	delusions	culture-bound syndromes	somatoform disorders
hyperactivity	Tourette's disorder	structural approach	commitment

APPENDIX D

SAMPLE INFERENCE TEST - ABNORMAL PSYCHOLOGY

Obsessive-compulsive disorder is characterized by the experience of recurrent obsessions or compulsions that are inordinately time consuming or cause specific stress or impairment. Adults with this disorder recognize that distressing thoughts and behaviors are unreasonable, although children may lack this insight. The disorder greatly interferes with an individual's life and traps the individual in a cycle of distressing, anxiety-provoking thought and behavior.

Obsessive thoughts and compulsive behaviors are usually inconsistent with the individual's conscious wishes, values, and personal style, and characteristically result in psychologically disordered behavior. The symptoms of OCD are time-consuming, irrational, and distracting, and the individual may strongly desire to stop them.

Researchers believe that obsessive thoughts lie along a continuum of strength. Some obsessions are fleeting thoughts, passing fancies, or reactions to certain situations. At the other end of the end of the spectrum, more serious obsessions are persistent and unpleasant, appear spontaneously, and are very difficult to control. People occasionally use the word "obsessed" to refer to a hobby or pursuit that consumes their energy, time, and thought. However, obsessions are different from matters that an individual may choose to become absorbed and spend time thinking about. Common obsessions reported in clinical populations include thoughts about contamination (e.g., by germs), repetitive doubts (e.g., leaving the gas stove turned on), distress about lack of order (e.g., when books are out of alphabetical order), aggressive images (e.g., hurting others), and graphic sexual imagery.

The most common compulsive rituals involve the repetition of a specific behavior, washing and cleaning, counting, putting items in order, checking, and requesting assurance.

STATEMENTS - FIRST SESSION

Circle "Y" if you believe a test sentence can be inferred to be true from the passage. Circle "N" if you believe it cannot.

1. Y N Just willing the thoughts to go away would not effectively prevent OCD from occurring.
2. Y N OCD can, and often does, cause a person to become increasingly dysfunctional, greatly interfering with their life.
3. Y N Obsessions are often found related to hobbies.
4. Y N One example of an OCD case would be when a student has recurring thoughts of shouting out in class and, in order to deal with them, feels the need to repeatedly screw and unscrew the cap of his ball-point pen.
5. Y N People perform compulsive behaviors because, deep down inside, they really want to.
6. Y N People who experience obsessions generally attribute the thoughts to outside forces.
7. Y N A man who has a rigid classification system for his CD collection to the point where he becomes upset when they are put out of order is probably suffering from obsessive-compulsive disorder.
8. Y N Although the thoughts that stem from OCD are very disturbing, they don't take up that much time or impair the person's performance on other tasks.
9. Y N One example of an OCD case would be when someone is so involved with stamp collecting that they constantly spend their extra money buying new stamps.
10. Y N Children who engage in ritual counting never realize that their behavior is unreasonable.
11. Y N Repetitive thoughts of ever-present germs in the environment could lead to OCD.
12. Y N In OCD, disturbing thoughts and behaviors interfere with the individual's life.
13. Y N Obsessions and compulsions often go hand-in-hand.
14. Y N Obsessive thoughts can be found on a spectrum that ranges from passing fancies to serious, hard to control, persistent thoughts.
15. Y N True obsessions are common, and almost everyone experiences them from time to time.
16. Y N Psychologically disordered behavior can be a result of thoughts that are inconsistent with a person's wishes.

1. Y N One example of an OCD case would be when someone is so involved with stamp collecting that they constantly spend their extra money buying new stamps.

2. Y N Psychologically disordered behavior is usually the result of thoughts that are consistent with a person's wishes.

3. Y N People who experience obsessions generally attribute the thoughts to outside forces.

4. Y N Obsessions are generally not found related to hobbies.

5. Y N The thoughts that stem from OCD are very disturbing, take up a lot of time and impair the person's performance on other tasks.

6. Y N Just willing the thoughts to go away would effectively prevent OCD from occurring.

7. Y N Obsessive thoughts can be found on a spectrum that ranges from passing fancies to serious, hard to control, persistent thoughts.

8. Y N OCD can, and often does, cause a person to become increasingly dysfunctional, greatly interfering with their life.

9. Y N A man who has a rigid classification system for his CD collection to the point where he becomes upset when they are put out of order is probably suffering from obsessive-compulsive disorder.

10. Y N In OCD, at least the disturbing thoughts and behaviors don't interfere with the person's life.

11. Y N Children who engage in ritual counting sometimes realize that their behavior is unreasonable.

12. Y N One example of an OCD case would be when a student has recurring thoughts of shouting out in class and, in order to deal with them, feels the need to repeatedly screw and unscrew the cap of his ball-point pen.

13. Y N People perform compulsive behaviors even though, deep down inside, they don't want to.

14. Y N Repetitive thoughts of the ever-presence of germs in the environment could lead to OCD.

15. Y N Obsessions and compulsions never go hand-in-hand.

16. Y N True obsessions are common, and almost everyone experiences them from time to time.

REFERENCES

Allard, W. G., Dodd, J. M., & Peralez, E. (1987). Keeping LD students in college. _Academic Therapy_, _22_(4), 359-365.

Anderson, J. R. (1993). _Rules of the Mind_. Hillsdale, NJ: Erlbaum.

Apthorp, H. S. (1995). Phonetic coding and reading in college students with or without learning disabilities. _Journal of Learning Disabilities_, _28_(6), 342-352.

Barbaro, F. (1982). The learning disabled college student: Some considerations in setting objectives. _Journal of Learning Disabilities_, _15_(10), 599-603.

Bireley, M., & Manley, E. (1980). The learning disabled student in a college environment: A report of Wright State University's program. _Journal of Learning Disabilities_, _13_(1), 12-15.

Blachman, B. A. (1996). Preventing early reading failure. In S. C. Cramer & W. Ellis, (Eds.), _Learning disabilities: Lifelong issues_ (pp. 3-61). Baltimore: Paul H. Brookes Publishing Co.

Borkowski, J. G. (1992). Metacognitive theory: A framework for teaching literacy, writing and math skills. _Journal of Learning Disabilities_, _25_(4), 253-257.

Brinckerhoff, L. C., Shaw, S. F., & McGuire, J. M. (1992). Promoting access, accommodations, and independence for college students with learning disabilities. _Journal of Learning Disabilities_, _25_(7), 417-429.

Bruck, M. (1988). The word recognition and spelling of dyslexic children. _Reading Research Quarterly_, _23_, 51-69.

Bruck, M. (1990). Word-recognition skills of adults with childhood diagnoses of dyslexia. _Developmental Psychology_, _26_(3), 439-454.

Bruck, M. (1992). Persistence of dyslexics' phonological awareness deficits. _Developmental Psychology_, _28_(5), 874-886.

Bruck, M. (1993). Word recognition and component procession skills of adults with childhood diagnosis of dyslexia. _Developmental Review, 13,_ 258-268.

Butler, D. L. (1995). Promoting strategic learning by postsecondary students with learning disabilities. _Journal of Learning Disabilities, 28_(3), 170-190.

Cisero, C. A. (1995). _Are there alternatives to the IQ-reading discrepancy? Evaluation of assessment techniques for identifying reading disabled college students._ Unpublished PhD. Dissertation, University of Massachusetts, Amherst, MA.

Cisero, C. A, Royer, J. M., Marchant, H. G., & Jackson, S. J. (1997). Can the Computer-based Academic Assessment System (CAAS) be used to diagnose reading disability in college students? _Journal of Educational Psychology, 89_(4), 599-620.

Cohen, J. (1984). The learning disabled university student: Signs and initial screening. _NASPA Journal, 21_(3), 22-31.

Compton, D. L., & Carlisle, J. F. (1994). Speed of word recognition as a distinguishing characteristic of reading disabilities. _Educational Psychology Review, 6_(5), 115-140.

Cowles, J. R., & Keim, M. C. (1995). The graduation rate, intellectual functioning level, and matriculation time of university students with learning disabilities. _College Student Journal, 29_(2), 145-149.

Cox, D. H., & Klas, L. D. (1996). Students with learning disabilities in Canadian colleges and universities: A primer for service provision. _Journal of Learning Disabilities, 29_(1), 93-97.

Cunningham, A. E., Stanovich, K. E., & Wilson, M. R. (1990). Cognitive variation in adult college students differing in reading ability. In T. H. Carr & B. A. Levy (Eds.), _Reading and its development,_ (pp. 129-159). San Diego, CA: Academic Press, Inc.

Curtis, M. E. (1980). Development of components of reading skill. _Journal of Educational Psychology, 72_(5), 656-669.

Dale, E., & O'Rourke, J. (1976). The living word vocabulary: The words we know. Field Enterprises Educational Corporation.

Day, S. L., & Edwards, B. J. (1996). Assistive technology for postsecondary students with learning disabilities. Journal of Learning Disabilities, 29(5), 486-492, 503.

Decker, T. W., Polloway, E. A., & Decker, B. B. (1985). Help for the LD college student. Academic Therapy, 20(3), 334-345.

Deshler, D. D., Schumaker, J. B., Lenz, B. K., & Ellis, E. (1984). Academic and cognitive interventions for LD adolescents: Part II. Journal of Learning Disabilities, 17(3), 170-179.

Ellis, E. S. (1993). Integrative strategy instruction: A potential model for teaching content area subjects to adolescents with learning disabilities. Journal of Learning Disabilities, 26(6), 358-383, 398.

Ellis, N., & Large, B. (1987). The development of reading: As you seek so shall you find. British Journal of Psychology, 78, 1-28.

Fourqurean, J. M., Meisgeier, C., Swank, P. R., & Williams, R. E. (1991). Correlates of postsecondary employment outcomes for young adults with learning disabilities. Journal of Learning Disabilities, 24(7), 400-405.

Francis, W. N., & Kucera, H. (1982). Frequency analysis of English usage: Lexicon and grammar. Boston: Houghton-Mifflin.

Gerber, P. J. (1994). Researching adults with learning disabilities from an adult-development perspective. Journal of Learning Disabilities, 27(1), 6-9.

Gillingham, A., & Orton, S. T. (1933). Detailed description of remedial work for reading, spelling and penmanship. In S. B. Childs, (Compiler), (1968), Education and specific language disability: The papers of Anna Gillingam: 1919-1963 (pp. 111-145). Pomfret, CT: The Orton Society.

Gillingham, A., & Stillman, B. (1969). Remedial training for children with specific disabilities in reading, spelling and penmanship. Cambridge, MA: Educators Publishing Service

Greene, B. A., & Royer, J. M. (1994). A developmental review of response time data that supports a cognitive components model of reading. Educational Psychology Review, 6(2), 141-172.

Gregg, N. (1996). Research directions leading toward inclusion, diversity, and leadership in the global economy. In S. C. Cramer & W. Ellis, (Eds.), Learning disabilities: Lifelong issues (pp. 121-133). Baltimore: Paul H. Brookes Publishing Co.

Groteluschen, A. K., Borkowski, J. G., & Hale, C. (1990). Strategy instruction is often insufficient: Addressing the interdependency of executive and attributional processes. In T. Scruggs & B. Wong (Eds.), Intervention research in learning disabilities (pp. 81-101). New York: Springer-Verlag.

Guyer, B. P., & Sabatino, D. (1989). The effectiveness of a multisensory alphabetic phonetic approach with college students who are learning disabled. Journal of Learning Disabilities, 22(7), 430-434.

Halgin, R. P., & Whitbourne, S. K. (1997). Abnormal psychology: The human experience of psychological disorders. New York: McGraw-Hill.

Haufrecht, B., & Berger, P. C. (1984). Adult psychoeducational disorders: An integrated approach. Social Casework, 65(8), 478-486.

Hildreth, B. L., Dixon, M. E., Frerichs, D. K., & Heflin, L. J. (1994). College readiness for students with learning disabilities: The role of the school counselor. School Counselor, 41(5), 343-346.

Houck, C. K., Asselin, S. B., Troutman, G. C., & Arrington, J. M. (1992). Students with learning disabilities in the university environment: A study of faculty and student perceptions. Journal of Learning Disabilities, 25(10), 678-684.

Johnston, C. L. (1984). The learning disabled adolescent and young adult: An overview and critique of current practices. Journal of Learning Disabilities, 17(7), 386-391.

Kemp, A. D. (1992). Counseling center psychologists in neuropsychology: counseling neuropsychology. The Counseling Psychologist, 20(4), 571-604.

Kochnower, J., Richardson, E., & DiBenedetto, B. (1983). A comparison of the phonic decoding ability of normal and learning disabled children. Journal of Learning Disabilities, 16(6), 348-351.

Kroll. L. G. (1984). LD's—what happens when they are no longer children? Academic Therapy, 20(2), 133-148.

Landmark College. (1998). Landmark College homepage, [On-line website]. Available: www.landmarkcollege.org.

Learning Disabilities Support Services. (1997). Modification of the foreign language requirement for students with learning disabilities. Unpublished policy guidelines, University of Massachusetts, Amherst.

LD Resources. (1997). LD Resources homepage, [On-line website]. Available: www.ldresources.com.

Lefebvre, C. R. (1984). A psychological consultation program for learning-disabled adults. Journal of College Student Personnel, 25(4), 361-362.

Levinson, E. M. (1986). School psychology and college learning disabled students: Training and service possibilities. Psychology in the Schools, 23(3), 295-302.

Lutwak, N., & Fine, E. (1983). Countertherapeutic styles when counseling the learning-disabled college student. Journal of College Student Personnel, 24(4), 320-324.

Lyon, G. R. (1996). The state of research. In S. C. Cramer & W. Ellis, (Eds.), Learning disabilities: Lifelong issues (pp. 3-61). Baltimore: Paul H. Brookes Publishing Co.

Malcolm, C. B., Polatajko, H. J., & Simons, J. (1990). A descriptive study of adults with suspected learning disabilities. Journal of Learning Disabilities, 23(8), 518-520.

Manis, F. R., Szeszulski, P. A., Holt, L. K., & Graves, K. (1988). A developmental perspective on dyslexic subtypes. Annals of Dyslexia, 38, 139-153.

Martin, E. W. (1996). Public policy: An agenda for the future. In S. C. Cramer & W. Ellis, (Eds.), Learning disabilities: Lifelong issues (pp. 71-76). Baltimore: Paul H. Brookes Publishing Co.

McBride-Chang, C. (1995). Phonological processing, speech perception, and reading disability: An integrative review. Educational Psychologist, 30(9), 109-121.

McGuire, J. M., & Shaw, S. F. (1987). A decision-making process for the college-bound student matching learner, institution, and support program. Learning Disability Quarterly, 10(2), 106-111.

McWhirter, B. T., & McWhirter, J. J. (1990). University survival strategies and the learning disabled college student. Academic Therapy, 25(3), 345-357.

Meintz, S. L. (1993). Causes of disintegration of compensation skills among adults with learning disability. Family and Community Health, 16(3), 9-21.

Mellard, D. F. (1994). Services for students with learning disabilities in the community colleges. In P. J. Gerber & H. B. Reiff (Eds.), Learning disabilities in adulthood (pp. 130-140). Austin, TX: Pro-ed.

Montague, M. (1993). Student-centered or strategy-centered instruction: What is our purpose? Journal of Learning Disabilities, 26(7), 433-437, 481.

The New American Bible With Revised New Testament. (1988). Nashville: Catholic Bible Press.

Norlander, K. A., Shaw, S. F., & McGuire, J. M. (1990). Competencies of postsecondary education personnel serving students with learning disabilities. Journal of Learning Disabilities, 23(7), 426-432.

O'Connor, R. E.; Jenkins, J. R.; Leicester, N; Slocum, T. A. (1993). Teaching phonological awareness to young children with learning disabilities. Exceptional Children, 59(6), 532-546.

Olson, R., White, B., Conners, F, & Rack, J. (1990). Organization, heritability and remediation of component word recognition and language skills in disabled readers. In T. H. Carr & B. A. Levy (Eds.), Reading and its development, (pp. 261-322). San Diego, CA: Academic Press, Inc.

Orzek, A. M. (1984). Special needs of the learning disabled college student: Implications for interventions through peer support groups. Personnel and Guidance Journal, 62(7), 404-407.

Patton, J. R., & Polloway, E. A. (1992). Learning disabilities: The challenges of adulthood. Journal of Learning Disabilities, 25(7), 410-415.

Pennington, B. F., Van Orden, G. C., Smith, S. D., Green, P. A., & Haith, M. M. (1990). Phonological processing skills and deficits in adult dyslexics. Child Development, 61, 1753-1778.

Perfetti, C. A. (1992). The representation problem in reading acquisition. In P. B. Gough, L. Ehri, & R. Treiman (Eds.), Reading acquisition. Hillsdale, NJ: Erlbaum.

Rack, J. P., & Olson, R. K. (1993). Phonological, IQ, and individual differences in reading disability: Genetic and environmental influences. Developmental Review, 13, 269-278.

Raskind, M. (1993). Assistive technology and adults with learning disabilities: A blueprint for exploration and advancement. Learning Disability Quarterly, 16, 185-196.

Raskind, M. H. (1994). Assistive technology for adults with learning disabilities: A rationale for use. In P. J. Gerber & H. B. Reiff (Eds.), Learning disabilities in adulthood (pp. 152-162). Austin, TX: Pro-ed.

Rath, K. A., Royer, J. M., & Tronsky, L. N. (1998). Is reading diagnosis a waste of time?: Cognitive profiles and instruction effectiveness. Paper presented at the annual meeting of the American Educational Research Association, San Diego, California.

Rath, K. A., & Tronsky, L. N. (1997). The LATAS Manual. Unpublished handbook.

Roffman, A. J., Herzog, J. E., & Wershba-Gershon, P. M. (1994). Helping young adults understand their learning disabilities. _Journal of Learning Disabilities, 27_(7), 413-419.

Royer, J. M. (1990). The sentence verification technique: A new direction in the assessment of reading comprehension. In S. Legg & J. Algina (Eds.), _Cognitive assessment of language and math outcomes_ (pp. 144-191). Norwood, NJ: Ablex Publishing Company.

Royer, J. M. (1997). A cognitive perspective on the assessment, diagnosis and remediation of reading skills. In G. D. Phye(Ed.), _Handbook of academic learning_ (pp. 199-234). San Diego, CA: Academic Press.

Royer, J. M., Carlo, M. S., & Cicero, C. A. (1992). School-based uses for the Sentence Verification Technique for measuring listening and reading comprehension. _Psychological Test Bulletin, 11_, 355-363.

Royer, J. M., Cisero, C. A., & Carlo, M. S. (1993). Techniques and procedures for assessing cognitive skills. _Review of Educational Research, 63_(2), 201-243.

Royer, J. M., Greene, B. A., & Sinatra, G. M. (1987). The sentence verification technique: A practical procedure for testing comprehension. _Journal of Reading, 30_(5), 414-422.

Royer, J. M., & Hambleton, R. K. (1983). _Normative study of 50 reading comprehension passages that use the Sentence Verification Technique_. Unpublished manuscript.

Royer, J. M., Hastings, C. N., & Hook, C. (1979a). A sentence verification technique for measuring reading comprehension. _Technical Report No. 137_. Urbana-Champaign, IL: The National Institute of Education.

Royer, J. M., Hastings, C. N., & Hook, C. (1979b). A sentence verification technique for measuring reading comprehension. _Journal of Reading Behavior, 11_(4), 355-363.

Royer, J. M., Kulhavy, R. W., Lee, J. B., & Peterson, S. E. (1986). The Sentence Verification Technique as a measure of listening and reading comprehension. Educational and Psychological Research, 6, 299-314.

Royer, J. M., Lynch, D. L., Hambleton, R. K., & Bulgareli, C. (1984). Using the Sentence Verification Technique to assess the comprehension of technical text as a function of subject matter expertise. American Educational Research Journal, 21(4), 839-869.

Royer, J. M., & Sinatra, G. M. (1994). A cognitive theoretical approach to reading diagnostics. Educational Psychology Review, 6(2), 81-113.

Royer, J. M., Souwaine, J., Tronsky, L. N., Rath, K. A., & Pajer, N. (1996, October). LATAS: evidence of an effective intervention for reading disabled children. Paper presented at the annual meeting of the Northeastern Educational Research Association, Ellenville, NY.

Runyan, M. K. (1991). The effect of extra time on reading comprehension scores for university students with and without learning disabilities. Journal of Learning Disabilities, 24(2), 104-108.

Scruggs, T. E., Mastropieri, M. A., Sullivan, G. S., & Hesser, L. S. (1993). Improving reasoning and recall: The differential effects of elaborative interrogation and mnemonic elaboration. Learning Disability Quarterly, 16, 233-240.

Scuccimarra, D. J., & Speece, D. L. (1990). Employment outcomes and social integration of students with mild handicaps: The quality of life two years after high school. Journal of Learning Disabilities, 23(4), 213-219.

Shaywitz, S. E., & Shaywitz, B. A. (1996). Unlocking learning disabilities: The neurological basis. In S. C. Cramer & W. Ellis, (Eds.), Learning disabilities: Lifelong issues (pp. 255-260). Baltimore: Paul H. Brookes Publishing Co.

Sinatra, G. M. (1989). Implementation and initial validation of a computer-based system for the assessment of reading competencies. Unpublished PhD. Dissertation, University of Massachusetts, Amherst, MA.

Sinatra, G. M., & Royer, J. M. (1993). Development of
cognitive component processing skills that support
skilled reading. Journal of Educational Psychology,
85(3), 509-519.

Small, W. (1996). Choosing a college for students with
learning disabilities. LD Resources homepage, [On-line
website]. Available: www.ldresources.com/
collegechoice.html.

Stanovich, K. E. (1980). Toward an interactive-
compensatory model of individual differences in the
development of reading fluency. Reading Research
Quarterly, 16(1), 32-71.

Stanovich, K. E. (1982). Individual differences in the
cognitive processing of reading: 1. Word decoding.
Journal of Learning Disabilities, 15(8), 485-493.

Stanovich, K. E. (1986). Matthew effects in reading: Some
consequences of individual differences in the
acquisition of literacy. Reading Research Quarterly,
21, 360-406.

Stanovich, K. E. (1988a). Explaining the difference
between the dyslexic and the garden-variety poor
reader: The phonological-core variable-difference
model. Journal of Learning Disabilities, 21(10), 590-
604, 612.

Stanovich, K. E. (1988b). The right and wrong places to
look for the cognitive locus of reading disability.
Annals of Dyslexia, 38, 154-177.

Stanovich, K. E. (1990). Concepts in developmental
theories of reading skill: Cognitive resources,
automaticity, and modularity. Developmental Review,
10, 72-100.

Stanovich, K. E. (1993). A model for studies of reading
disability. Developmental Review, 13, 225-245.

Stanovich, K. E. (1994). Romance and reality. The Reading
Teacher, 47(4), 280-291.

Stanovich, K. E., & Siegel, L. S. (1994). Phenotypic
performance profile of children with reading
disabilities: A regression-based test of the
phonological-core variable-difference model. Journal
of Educational Psychology, 86(1), 24-53.

Stanzel, S. M. (1996). Academic accommodations: A personal view. In S. C. Cramer & W. Ellis, (Eds.), <u>Learning disabilities: Lifelong issues</u> (pp. 95-98). Baltimore: Paul H. Brookes Publishing Co.

Steere, A., Peck, C. Z., & Kahn, L. (1968). <u>Solving Language Disorders</u>. Cambridge, MA: Educators Publishing Service.

Strichart, S. S., & Mangrum, C. T. II. (1985). Selecting a college for the LD student. <u>Academic Therapy</u>, <u>20</u>(4), 475-479.

Sullivan, A. P., Nicolellis, D. L., Danley, K. S., & MacDonald-Wilson, K. (1993). Choose-get-keep: A psychiatric rehabilitation approach to supported education. <u>Psychosocial Rehabilitation Journal</u>, <u>17</u>(1), 55-68.

Swanson, H. L. (1990). Instruction derived from the strategy deficit model: Overview of principles and procedures. In T. Scruggs & B. Wong (Eds.), <u>Intervention research in learning disabilities</u> (pp. 34-65). New York: Springer-Verlag.

Swanson, H. L. (1994). Short-term memory and working memory: Do both contribute to our understanding of academic achievement in children and adults with learning disabilities? <u>Journal of Learning Disabilities</u>, <u>27</u>(1), 34-50.

Venezky, R. L. (1970). <u>The structure of English orthography</u>. The Hague, Netherlands: Mouton.

Vogel, S. A. (1982). On developing LD college programs. <u>Journal of Learning Disabilities</u>, <u>15</u>(9), 518-528.

Vogel, S. A., & Adelman, P. B. (1990). Intervention effectiveness at the postsecondary level for the learning disabled. In T. Scruggs & B. Wong (Eds.), <u>Intervention research in learning disabilities</u> (pp. 329-344). New York: Springer-Verlag.

Vogel, S. A., & Adelman, P. B. (1992). The success of college students with learning disabilities: Factors related to educational attainment. <u>Journal of Learning Disabilities</u>, <u>25</u>(7), 430-441.

Westberry, S. J. (1994). A review of learning strategies with adults with learning disabilities preparing for the GED exam. _Journal of Learning Disabilities_, _27_(4), 202-209.

White, W. J., Alley, G. R., Deshler, D. D., Schumaker, J. B., Warner, M. M., & Clark, F. L. (1982). Are there learning disabilities after high school? _Exceptional Children_, _49_, 273-274.

Wilczenski, F. L. (1993). Comparison of academic performances, graduation rates, and timing of drop out for LD and nonLD college students. _College Student Journal_, _27_(2), 184-194.

Wilczenski, F. L., & Gillespie-Silver, P. (1992). Challenging the norm: Academic performance of university students with learning disabilities. _Journal of college Student Development_, _33_, 197-202.

Woolfolk, A. E. (1998). _Educational psychology, seventh edition_. Boston: Allyn and Bacon.

Working Party on the Needs of the Dyslexic Adult. (1974). _People with dyslexia_. London: The Council.

Wren, C., Williams, N. & Kovitz, V. (1987). Organizational problems at the college level. _Academic Therapy_, _23_(2), 157-165.

Yost, D. S., Shaw, S. F., Cullen, J. P., & Bigaj, S. J. (1994). Practices and attitudes of postsecondary LD service providers in North America. _Journal of Learning Disabilities_, _27_(10), 631-640.