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LETTER FROM THE EDITORS

To our readers:

We continue to be energized by the quality, scope and creativity that is so evident in the manuscripts we receive for the journal. Learning assistance practitioners are increasingly engaged in significant research that comes directly from their work and lends a new strength to the field.

The first article in this issue, contributed by Shevawn Eaton, combines both a theoretical framework and practical suggestions for working with Attention Deficit Disordered (ADD) students. This population is increasing at the postsecondary level, and Eaton's experience provides an excellent base of information for us to share with faculty across our institutions.

The next two articles examine a well-researched instructional model, Supplemental Instruction, from two very different perspectives. In the first, Peled and Kim analyze the effectiveness of Supplemental Instruction in a high-risk Biology course by comparing the overall achievement of its students to those in a non-Supplemental Instruction Biology section. The second article describes an adaptation of the traditional supplemental instruction model to a pre-college summer program for high school students. Written by Steven Timmermans et. al., it details the implementation of a program called Intensive Developmental Instruction at a small, private college.

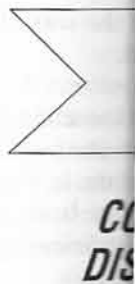
In Join the Conversation for this issue, Gene Beckett, former president of NADE makes the argument that although the benefits of developmental education are far-reaching, we have not publicized them very well. He presents evidence that should stimulate us to "join in" and extol the virtues of what we do.

Nancy Bornstein reviews the 1996 publication, *Changing the Odds: Open Admissions and the Life Chances of the Disadvantaged*. This book presents the results of a longitudinal research study conducted to evaluate the outcomes of CUNY's open admissions policy instituted in the 70's. It is particularly significant in light of recent federal legislation and calls for reducing "remedial" programs in four year postsecondary institutions. For our readers, this book is an interesting follow-up to *City on a Hill*, reviewed in the Spring, 1996 volume.

Once again we urge you to read with a critically reflective mind and relate these articles to your practice. Write to us with your reflections and examples from your own experiences.

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ARTICLES

COLLEGE STUDENTS WITH ATTENTION DEFICIT DISORDER (ADD): IMPLICATIONS FOR LEARNING ASSISTANCE PROFESSIONALS

By Shevawn Eaton and Sharon Wyland, Northern Illinois University

Abstract

More students with Attention Deficit Disorder are coming to college than ever before. Because many of the symptoms of the disorder involve learning, those of us who work within learning assistance, academic support services, and developmental education are increasingly faced with the needs of students with ADD. The more that learning assistance professionals know about ADD, its symptoms and its treatment, the better this growing population of students can be served. The purpose of this article is to examine the research and theory about ADD in college students, and discuss how learning assistance professionals can better assist college students with ADD.

Recently, in a conversation with a colleague, a faculty member voiced his concern about Shelly, a student in his class. "She's always late," he said, "and often shows up completely unprepared for class, even though we worked together the day before." His frustration, however, was not so much about these characteristics, as it was about Shelly's erratic performance. "On some days, she comes up with the most incredible thoughts about the topic we are discussing. Her work can be excellent. But on other days, she spends the entire class doodling. She seems to be paying attention, but something doesn't seem right, like she somehow is not really there. When I call on her, she can paraphrase what we are discussing, but her understanding seems 'wobbly' somehow, as though she is just not getting it."

He went on to talk about her exams. "She says she studies, and I believe her, but her exams have been very poor. I have tried to break down concepts into small parts, but she gets caught up in just memorizing lists and just can't grasp the larger issues. She told me that she panics during the exams as soon as she sees a question she can't answer. She is just sure she is going to fail." And sadly, Shelly

usually does. His frustration was not that Shelly wasn't trying, but that she wasn't making progress in the course despite her efforts, and his, to succeed.

Is this a case of an average student having problems in a class, or is it something more? Students with Attention Deficit Disorder may look a lot like other students, but the problems can be much more deeply rooted, and the frustration to the students and those who work with them can be great. Sensitivity to how a student with ADD may appear in the college environment can help a learning assistance professional work more effectively in enhancing student success.

Currently, the incidence of Attention Deficit Disorder (ADD) in college students has been estimated from anywhere between 1% and 9% (Faigel, 1995; Barkley, 1993). As awareness of the disorder increases, so too are numbers of school age children being diagnosed (Westby & Cutler, 1994). Along with better definitions and increases in diagnosis has come successful treatment of many of the symptoms that are associated with ADD. The result is that more students with the disorder are and will be attending college. Consequently, more than ever before, those of us who work with learning assistance programs, academic support services, and developmental education will be faced with the needs of students with ADD.

As more is learned about the disorder, the stereotype of students with ADD continues to change. Because ADD is a disorder that has a direct effect on educational activities and demands, a college learning center is one resource these students are likely to turn to for assistance. While many students come to college knowing that they have ADD, pressures of the academic environment may encourage them to seek new coping strategies. The college experience may motivate others to seek assistance with academics for the first time. The more that learning assistance professionals know about ADD, its symptoms and its treatment, the better this growing population of students can be served. In this article, we will address several issues that will touch learning assistance providers as the number of students with ADD on campus continues to increase.

Specifically, four questions will be addressed here, based on the research and theory that have emerged in the last several years. These include:

1. What is Attention Deficit Disorder?
2. What are the characteristics of college students with ADD?
3. What are some reasons for learning assistance professionals should increase their knowledge of ADD?
4. How can learning assistance professionals help meet the needs of college students with ADD?

What is Attention Deficit Disorder?

According to the Diagnostic and Statistical Manual of Mental disorders, fourth edition (DSM-IV), Attention Deficit Hyperactivity Disorder (referred to as ADD in this article) is a complex mental disorder with three primary types of symptoms. The categories of symptoms include inattention, hyperactivity and impulsivity (American Psychiatric Association, 1994). Individual cases may demonstrate any combination of these characteristics.

Observable symptoms of the disorder include "difficulty directing attention appropriately, impulsive behavior, hyperactivity, mood swings, low stress tolerance, and difficulty in following rules. It is an invisible disability that often affects an individual's performance in early school years, postsecondary education, and throughout life" (Latham, 1995, p. 53). Individuals frequently report being unable to concentrate in social and educational situations, often drifting off or appearing "spacey." They may also be distracted or experience concentration difficulties when faced with certain elements of the surrounding environment, including noise, light or movement. Individuals with ADD also seem to be prone to accidents. Further, the disorder is often accompanied by other disorders, including mood disorders, depression and most frequently, learning disabilities (Cantwell & Baker, 1992; Barkley, 1990). In sum, ADD may interfere with academic, social and emotional components of an individual's life (Faigel, 1995).

Historically, ADD was diagnosed as a disorder that affected children. It was thought that most outgrew the disorder by puberty. More recent research, however, determined that while in many cases the symptom of hyperactivity may decrease or disappear at puberty, other symptoms of the disorder such as poor concentration and difficulty with organization may be with the individual through life (Denckla, 1993; Wender, 1987). In follow-up studies of adults that were diagnosed in childhood, 50% to 80% were found to exhibit some symptoms of ADD into adulthood (Leimkuhler, 1994; Hallowell & Ratey, 1994; Hechtman, 1989; Gittleman, Manuzza, Shenker, & Bonguara, 1985; Weiss, Hechtman, Milroy, & Perlman, 1985).

Perhaps one of the most perplexing characteristics of ADD is the variation in specific symptoms from one case to another. Different individuals with the disorder can exhibit polar opposite symptoms. For example, one individual can be hyperactive and impulsive (usually labeled as ADHD), while another may be quiet and withdrawn (ADD without hyperactivity). Some individuals may be severely distracted by external environmental factors, while others can easily adapt (Leimkuhler, 1994). In short, no single stereotype fits the profile of all individuals with ADD, making diagnosis tricky at best.

Those individuals that exhibit hyperactivity as a child are more likely candidates for correct diagnosis. Those that do not conform to this stereotype, however, may never be identified, or may be identified much later in life. This is especially the case for bright students who develop successful coping strategies for educational settings prior to their college experience (Lahey & Carlson, 1992).

Along with the clarification of a definition for ADD from a medical and psychological perspective, in recent years, the disorder has also received clarity from a legal perspective. Under the protection of the Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973, ADD has become accepted as a disability that requires accommodation. This recognition requires that postsecondary institutions like other educational institutions have an obligation to provide services and assistance for this population (Latham, 1995). The legal rights of students with ADD are comparable to those of students with other disabilities, that of "reasonable accommodation." The result is not only the increase of such students on college campuses, but also the expected reaction of institutions to meet the needs of these students.

What Are The Characteristics of College Students with ADD?

As mentioned earlier, a student with ADD who enters a learning center probably will look like many other students in need of academic support services. It is beneficial, however, for those who work with such students to be aware of cues in behavior that may suggest a more complicated problem. Willis, Hoben and Myette (1995) provide a theoretical framework that helps to characterize college students with ADD. The framework includes five key components which will be summarized here: self-esteem, family and peer support, stress, organizational skills, and personal resistance/acceptance of the disorder as a part of life.

Self-Esteem

Individuals with ADD, like many other students with disabilities that affect learning, experience negative academic self-esteem that is brought on by a number of factors. Many students with ADD have a history of inconsistent performance in academic work, often ranging from A's to F's (Javorsky & Gussin, 1994). Teachers often characterize this phenomenon as a lack of effort or laziness (Leimkuhler, 1994). Accordingly, while these students often recognize their own potential, they also witness their own underachievement (Ratey, Greenberg, Bemporad, & Linden, 1992). Consequently, they have a poor academic self-concept that can cause an increase in stress in future academic settings. Such students may develop self-defeating attitudes, which, when compounded by concentration deficits from the disorder, may create a downward spiral of failure.

The combination of failure and frustration in academic settings can result in depression. The incidence of depression in students with ADD is so common that it is difficult to determine if the depression is a coexisting condition with ADD or one brought on because of it.

Apart from the academic context, self-esteem in social situations is also affected by the disorder. As children, many students with the disorder felt stigmatized by their peers (Willis, Hoben, & Myette, 1995). Labeling in school and being singled out for special programs and services or disciplinary problems were a constant reminder that they were different.

In social situations as well as academic ones, concentration and focus problems contribute to esteem problems for students with ADD. Some may "space out" during conversations, or they may not respond when addressed. They may also frustrate peers with their hyperactive or impulsive behaviors. These social failings frustrate students with ADD, making them more sensitive and subject to bursts of anger or social withdrawal, both symptoms of weak self-esteem.

Family and Peer Support

ADD creates an isolation for many students with the disorder. It is therefore very important that an individual with ADD is made to feel supported by family and friends. Such relationships can be crucial to a student's academic success (Willis, et al., 1995). "When any part of the family or friends' support system is primarily negative, a student with ADD may expend additional energy repairing his/her psychological wounds" (p. 39).

Friendships and long-term personal relationships can be difficult and complex for individuals with ADD. For many, the distractibility and impulsiveness of the disability interfere with the ability to build a foundation for personal and social relationships (Ratey, et al., 1992). Many experience multiple failures in relationships. Some may protect themselves by avoiding relationships while others establish complex, co-dependent relationships because of their own insecurities (Ratey, et al., 1992). Studies have also shown that children with ADD were found to be less popular in school than their peers, some being actively disliked, and others choosing to be socially inactive (Lahey & Carlson, 1992).

Stress

The continuing battle that students with ADD face over symptoms of the disorder is extremely frustrating. Because the college environment often intensifies many of these symptoms, students may tend to overreact to stressful situations (Aust, 1994). The individuals may exhibit emotional difficulties, such as mood swings or

bursts of anger. They may try to self-medicate by turning to illegal drugs and alcohol to deal with their symptoms and their stress. "The level of stress for these students seems to be greater than that of their college peers because of the typical attributes of ADD and learning disabilities" (Willis, et al., 1995, p. 39). In particular, the stressors that college can present to these individuals include responding to deadlines, time limits on exams, exams which are poorly written or difficult to comprehend, multiple choice tests, and lack of structure in academic tasks (Willis, et al., 1995).

Organizational Skills

Organizational problems resulting from the disorder can manifest themselves in a number of ways. For some students, problems may occur when attempting to create structure within course work where little or none exists. Other problems may be in the areas of time management, test preparation or organizing work necessary to write a paper. A larger problem may be an inability to gain a "big picture" perspective from lectures and/or readings by making connections between details and major themes and constructs (Nadeau, 1995; Willis, et al., 1995; Leimkuhler, 1994).

Daily tasks requiring organizational skills may also demonstrate symptoms of the disorder. Students may have problems being on time for classes and meetings. Their finances may always be in turmoil, and they may have difficulty in managing money. They may also have problems in getting and keeping a job (Javorsky & Gussin, 1994).

Personal Resistance/Acceptance of the Disorder

In college, when many students are facing issues of independence, student with ADD may choose this point to disregard the disorder and ignore the support services, medication and other help that has guided them in the past (Willis, et al., 1995). The reaction to the disorder of ADD can be varied among individuals, ranging from extreme relief at an initial diagnosis to complete denial. The reactions and choices in coping with the disorder may also change within an individual over time. The result of such reactions can feed into the inconsistent array of successes and failures that many such students experience. In short, growing to accept the disorder can be difficult, but acceptance will increase a student's capacity for academic, personal and social success.

What Are Some Reasons That Learning Assistance Professionals Should Increase Their Knowledge of ADD?

The number of students with ADD who are attending college is on the increase. This is due to a number of factors. The use of Ritalin and other medications has been shown to be successful in assisting children in increasing concentration and attention in educational settings. Before the advent of successful diagnosis and treatment, hyperactivity and inability to concentrate made many individuals with the disorder turn away from education (Javorsky & Gussin, 1994). Now, more students are able to have successful and positive experiences in school, thus encouraging more of them to attend college.

In addition, individuals with moderate ADD or ADD without hyperactivity may be more difficult to diagnose early in their educational experience. Particularly, if students come from high school environments where classes were small, academics were well structured, and in which they received large amounts of support from family and friends, they may have been able to accommodate for problems effectively (Nadeau, 1995). In college, however, the environments are often quite different, and these differences can affect performance.

The increased intensity of course work, challenging reading, difficult assignments and examinations, a less structured academic environment and a change in support structure may all tax a student who has coped successfully in the past. Students with ADD can be particularly sensitive to distractions, such as variations in noise and light (Latham, 1995). College life is filled with a variety of challenges to someone with such sensitivities. The combined elements of the college experience may intensify symptoms, bringing many students to counselors, physicians and learning centers for assistance for the first time.

A learning center has at its disposal some key interventions that can assist such students to become successful. Research has shown that basic learning and study skills, time management and test taking strategies provide a good foundation to assist these students. But other interventions, either medical or psychological, may also be necessary. To be most effective, learning assistance professionals should collaborate with other offices on campus when beginning to work with a student with ADD.

Students may come to a learning center self-reporting the disorder, or a learning assistance professional may suspect a certain student has ADD. In either case, diagnosing the disorder should fall to a psychiatrist or physician using the DSM-IV. Documentation of the diagnosis should be available on campus, usually in the office for disabled student services. That office can also provide insights into how to approach an undiagnosed student in making an effective referral.

A good diagnostic report is one that includes a clinical diagnosis as well as other evaluative information. Most important for the learning center is a list of recommendations and accommodations, supported by evaluative data on the student, including academic support services that can be provided by the center.

Learning assistance professionals who are able to make educated referrals and connections with other campus and medical services, offer students with ADD the best opportunity to acquire a comprehensive intervention program that can help overcome what could be a lifetime of academic and social problems. For many students, diagnosis of the disorder, and some direction in terms of supports, can bring great relief and an understanding of performance problems in college.

How Can Learning Assistance Professionals Help Meet the Needs of College Students with ADD?

Students with ADD have a number of specific academic needs. However, because ADD frequently is found to be associated with other learning, cognition and emotional disorders, the needs of students with ADD cover medical and psychological areas as well (Shaywitz, Fletcher & Shaywitz, 1994). As stated earlier, it is advisable for learning assistance personnel to develop a collaborative approach with other professionals, especially those in disabled student services, in working with students to achieve the best possible support system. However, there are some consistent academic needs within the group of college students who have the disorder that can be addressed by learning assistance.

In a learning center, a variety of strategies and supports can be offered for students with ADD. These include developmental course work, academic counseling, tutoring services, special services for exam situations, enhancement of organizational skills, advocacy, and education of professors and staff (Weiss & Hechtman, 1993).

Developmental course work is a good beginning service for a number of students with ADD. These courses inherently are designed to address many of the typical problems experienced by students with the disorder. Since students who have ADD are often characterized as having spotty skill development (due to concentration problems) and study skill weaknesses (due to poor organization), such course work would be of great benefit to fill in the gaps that the disorder may have created in previous educational experiences (Javorsky & Gussin, 1994; Nadeau, 1995).

Students with ADD require support from learning centers in getting and staying organized but perhaps with more attention to the unique characteristics of the individual student's particular form of disorganization. Assessment and diagnosis

of organizational problems is imperative for the student with ADD, as is gaining strategies that are effective in moving towards better organization. Perhaps the most important tool that students with ADD can gain from those of us that work with learning assistance is the ability to build structure where none exists.

As with all students who need academic support services, students with ADD can gain self-esteem when given opportunities to feel successful in academic and social situations. Learning assistance staff who are supportive and positive in their interactions with such students can provide them with opportunities for esteem building and personal growth. They can also assist in helping students structure academic activities in ways in which they can achieve small successes that can build a foundation for more consistent, future accomplishments.

In addition to academic successes, those who work with students who have ADD can also, through peer and professional relationships, provide opportunities for these students to begin building positive and supportive relationships that can enhance academic and social integration into the institution.

Educators have the capacity to build trust with students in significant ways. Being in a trusting relationship with a learning assistance professional, the student may be more receptive to a recommendation to seek out assistance in dealing with personal and psychological problems through counseling or psychological services. As with most other students who require academic assistance, often it is the recognition that someone genuinely cares for the individual that motivates the student to change in positive directions and become successful in many areas of life.

Another service that learning assistance personnel can provide which can contribute to a student's academic achievement in college is attention to planning, organization and goal setting. Depending on the needs of the student, planning can encompass a range of considerations from day-to-day activities to short and long term educational, career and personal goals. In terms of long range goals, students may need assistance in choosing a career that best matches their skills and abilities. In the short term, they also may require advice in registering for a course load which offers a balanced combination of courses, particular teaching styles and a good match between skills and course requirements (McKinney, Montague & Hocutt, 1993).

Leimkuhler (1994) provides some specific recommendations for assisting students with ADD with short term organizational problems. These include using a calendar, breaking tasks into smaller pieces and working on them in priority order, establishing personal deadlines for smaller pieces of an entire project and creating an environment that minimizes distractions, interruptions and stressors.

Coping with all types of stressors is another important part of adjustment to college for students with ADD. Learning assistance can offer students with ADD many ways of dealing with stress caused by academic tasks such as taking exams or meeting deadlines. Stress management and coping strategies, time management and test taking skills can assist students in taking control. Academic stress caused by poor test performance, comprehension or writing problems may be best addressed through academic services, especially tutoring.

Students with ADD are found to perform better in one-on-one or small group learning situations than in large groups (Javorsky & Gussin, 1994). Tutors who understand the special problems of students with ADD will gain a better understanding of how the disorder affects the tutoring relationship. Tutors also play an important role in helping students learn to stay organized, overcome procrastination and stay motivated. They can coach them on specific skills such as memory enhancement, test preparation and academic problem solving (Leimkuhler, 1994; Weinstein, 1994).

Individual contact with other positive role models is a good way to help a student with ADD become more successful. "Coaching" and "anchoring" are two treatment models for assisting students with ADD.

"Coaching," as a specific type of assistance for students with ADD, has been shown to be a highly effective way to enhance success with adults (Hallowell & Ratey, 1994). The coach can be a therapist, friend or colleague who is willing to invest time and regular conversation with an individual with ADD. An ADD coach works to help keep the individual with ADD focused on the task at hand and offer encouragement along the way. She takes time to help the student clarify goals, and maintain the day-to-day activities needed for success.

An important success factor for adults with ADD is the presence of a positive role-model or mentor. College students with ADD can benefit by "anchoring" themselves to a counselor, faculty member, learning assistance professional or a successful older student with ADD. Having an "anchor" or a coach available can greatly assist students in more rapid recovery from setbacks and in avoiding prolonged downward spirals in academic performance or emotional adjustment (Richard, 1995).

In addition to individual assistance, outreach and advocacy are important roles that learning assistance professional must play to educate faculty, staff and administrators about students with ADD. Faculty education, for example, can be an important part of a student's success. The quality and style of teaching can have a large impact on the performance of the student with ADD. Students with

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ADD benefit from instruction that is multisensory. Faculty who are able to shift their teaching to accommodate can provide significant benefits.

Faculty need to be aware that ADD is not an excuse for special treatment, but a disability that requires special accommodation and understanding. Small changes in traditional presentation of material such as preferential seating, providing lecture outlines and copies of overhead transparencies in advance, a quiet non-distracting environment, and extra time for exams can help a student dramatically (Faigel, 1995).

Javorsky and Gussin (1994) provide a series of recommendations for faculty that can help students with ADD in their courses, as adapted from Vogel (1993). They suggest a number of practices that can assist faculty in streamlining course experiences in ways that can help all students, but most specifically can improve the organization, comprehension and academic success of students with ADD. Sensitized faculty, staff and administrators may be more willing to open the door to negotiations for the special services a student with ADD may need to be successful. An adaptation of specific recommendations for faculty and exam situations is included in Appendix A. Appendix B provides a list of twelve suggested readings for faculty, learning assistance professionals and students.

Perhaps the most important consideration when working with students with ADD, is offered by Weiss and Hechtman (1993): "When adult subjects assessed the treatment they had received as children and what factors had helped them the most, they chose individual persons (a parent, teacher, a counselor, or a friend) who had been particularly significant for them" (p. 218). As it is with other populations of students who require academic support services, for students with ADD, it is the perception of care, mentorship and belonging that can make a student become successful.

Appendix A
Strategies for Faculty/Learning Center Professionals
in Accommodating Students with ADD

Author's Note: Strategies which faculty can employ to assist students with ADD are effective strategies that will enhance success for *ALL* students. The strategies and suggestions listed here do not require extra time and/or effort, but rather are simply good teaching practices that would be appreciated by any student.

- ▶ Making the syllabus available four to six weeks before the beginning of class, and when possible, discussing it in advance with students considering the course.
- ▶ Beginning lectures with a review of the previous lecture and an overview of topics to be covered that day.
- ▶ Emphasizing important points, main ideas, and key concepts orally and/or highlighting them.
- ▶ Speaking distinctly and at a relaxed pace, pausing to respond to questions or for students to catch up in their note-taking.
- ▶ Noticing and responding to nonverbal signals of confusion or frustration with explanations and assistance.
- ▶ Trying to eliminate or at least reduce auditory and visual classroom distractions such as outside noise.
- ▶ Leaving time for a question-answer period and/or discussion periodically and at the end of each lecture and providing periodic summaries and highlights.
- ▶ Giving assignments in writing as well as orally.
- ▶ Being available during office hours for clarification of lecture material, assignments, and readings.
- ▶ Offering question and answer sessions, and/or review sessions.
- ▶ Providing study questions for exams that show test format and content.

- ▶ Encouraging students to schedule difficult classes in accordance with their individual "body clocks."
- ▶ Encouraging students to enroll in classes that are small (under 30 students) and scheduled for short durations of time (under one hour and fifteen minutes).
- ▶ Encouraging students to schedule classes to allow for breaks in between them, especially classes that require intense concentration for lectures and note taking.
- ▶ Allowing students to enroll in a reduced course load and extending the time for completion of degree requirements.
- ▶ Working cooperatively with the Disabled Student Services office as resources for each other to verify the appropriateness of a particular accommodation with a particular student.

Suggestions for Specific Testing and/or Evaluation Accommodations

- ▶ Allowing extended time for exams.
- ▶ Providing the exam in an alternate format (e.g., essay versus objective).
- ▶ Permitting students to take exams in a room that is distraction-free, allowing students the privacy needed to subvocalize to maintain attention and recall of information.
- ▶ Allowing students to answer exam questions using methods other than handwriting (such as, orally or typing).
- ▶ Allowing students to verify an exam question by rephrasing.
- ▶ Providing alternatives to exams to show mastery of course objective (e.g., a research project, class presentation).
- ▶ Allowing students to use computational aids, such as a calculator, and word processing assistance for exams.
- ▶ Avoiding complex sentence structure, such as double negatives and embedding questions within questions on exams.

- Providing ample blank space or additional exam booklets for students with overly large handwriting.

Adapted from Javorsky, J., & Gussin, B. (1994, May). College students with attention deficit hyperactivity disorder: An overview and description of services. Journal of College Student Development, 35(3), 170-177.

Appendix B
Suggested Reading for Faculty, Learning
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EVALUATION OF SUPPLEMENTAL INSTRUCTION AT THE COLLEGE LEVEL

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Abstract

Supplemental Instruction (SI) is a model of academic support that has been used effectively at the college level to promote higher-level thinking skills in an interactive setting. We analyze this model as used for a high-risk biology course on a multicultural, multiethnic university campus. Examination grades indicated that the average grade of participants in classes that had SI sessions was significantly higher than that of participants in classes where SI sessions were not offered. Assessing the effect of SI in this way avoids the bias of comparing students of the same class who attend SI sessions with students who do not attend.

Introduction

In this paper we describe a new method of evaluating the Supplemental Instruction (SI) model as implemented in biology courses at an urban multicultural university campus. Classes with and without SI leaders were compared, instead of final grades of students who did or did not participate in SI sessions.

Supplemental Instruction is an integrative model of student academic support that was developed and tested during the mid 1970's at the University of Missouri (Blanc, DeBuhr & Martin, 1983), and implemented at 150 institutions of higher education (National Center for Supplemental Instruction [NCSI], 1994). It is a process-product paradigm that determines its success by the final grades of students who attend or do not attend the SI sessions.

Garland (1987) conducted a study of students at 13 institutions to test whether SI was effective for minority students at both ends of the academic spectrum. The study reports that students in the SI group benefitted across all grade levels at a significance of 0.0001. For example, SI students in the lowest quartile and the highest quartile scored at about a 0.5 letter grade higher than non-SI students in the same quartile. In addition, the rate of D's, F's, and Withdrawals (W's) among SI students was 7% less than for non-SI students. Blanc, DeBuhr and Martin (1983) report similar results regarding the effectiveness of SI for students of different levels of academic preparedness by analyzing the performance of

students in seven courses who scored in the top and bottom quartiles of college entrance tests. Approximately 30% of students in both the top and the bottom quartiles participated in the sessions. Students participating in SI scored at about a 0.8 grade higher in both the top and the bottom quartiles than ones not participating. It also appeared that SI was associated with reduced D, F and W grades, increased re-enrollment and higher GPA. Kallison and Kenney (1992) compared the grades earned by students in a calculus course. Students who attended SI sessions earned between 0.1 and 0.4 of a letter grade higher than students who attended conventional tutorials. The same study reports that lower-ability students benefitted from SI more than higher-ability students.

The use of the SI model of academic support has recently been reported to attract minority students to medicine (Bridgham & Scarborough, 1992), to benefit problem-solving in chemistry courses (Congos, 1993), and to increase organizational skills and create learning strategies in biology (Matthews, 1993).

The present study on the effect of SI in biology was conducted over the course of three years at National-Louis University (NLU), a private university with several campuses in the Chicago area, as well as throughout the US and overseas. The population at the urban campus, the site of this study, has a high percentage of minority students: approximately 20% are African-American, 10% Hispanic, and 6% Asian. This is about three times higher than minority percentages in Garland's (1987) study.

The coordinator of the SI program determined that General Biology and Introduction to Music were "high-risk" courses and eligible for the SI program since fifty percent of the students were receiving grades of D or F, or W. Most students take General Biology to fulfill the science requirement of their programs. The course emphasizes the concepts of biology and serves as a prerequisite for all subsequent biological science courses.

At NLU the SI leaders are students who have successfully completed the course and are recommended by the instructor to the SI coordinator. Moreover, most of the SI leaders in Biology are students intending to major in elementary education. In their role as SI leaders, they attend the lectures and laboratories and serve as role models for the currently enrolled students. The SI coordinator trains the leaders, making sure that the SI leaders' interactions with the students promote higher-level thinking skills rather than a repetition of the lecture.

The conventional method of assessing the success of the SI program is to compare the achievement of students who attended SI sessions with those who did not (Blanc, et al., 1983; Lundeberg, 1990; Martin & Arendale, 1991; NCSI, 1994). However, despite the claims of the authors of the SI model (Blanc, et al., 1983),

this type of comparison is liable to be grossly biased because the students are not randomly assigned to the SI or non-SI groups. Rather, they are self-selected, so it is very possible that the better students, who would have received the better grades in the first place, tend to be the ones who attend the sessions. Indeed, Visor, Johnson, and Cole (1992) reported that students who attended SI sessions regularly were the ones who possess high self-esteem, and found active participation in such sessions to be academically challenging.

In order to avoid this bias, we assessed the success of the SI sessions by comparing the test scores of whole classes, some, but not all, of which had an SI leader. (The SI leaders were available for only some of the Biology classes, choosing a class to work with based on their own schedules.) If SI participants are compared with non-participants within the same class, one cannot distinguish whether better performance is due to SI or rather to the difference in student characteristics. Our approach avoids this particular bias. We assume that the groups of students in different classes for the same course are equivalent and may therefore be compared.

Our approach of comparing whole classes does not permit direct inference as to which students profit from SI. Not surprisingly, the influence of the SI sessions is affected by the degree of student attendance. Blanc, DeBuhr and Martin (1983) reported a decrease in D, F and W grades with the increase of participation in SI sessions. In our study, attendance at sessions was voluntary, so only some students attended the SI sessions, and those participating attended irregularly. We assume that the amount of participation in sessions increased the success of the class as a whole. It is, therefore, possible that with full attendance the effect of offering SI could have been even stronger than it appears from our data. We estimated what the full contribution of SI would have been had all students participated fully.

We tested two hypotheses: 1) that the percent of very low grades was significantly decreased in classes with SI, and 2) that the average grade of the whole class increased in the classes with SI.

Materials and Methods

From the Winter of 1990 through the Winter of 1993, fourteen classes of General Biology were taught by the same instructor, using the same textbook and the same syllabus. An SI leader was available for five of those classes. Classes at NLU are typically small, approximately 20 students; a total of 94 students attended the classes where a leader was available, and 140 attended classes without one. The SI leader conducted sessions immediately before or after the class. The instructor sometimes assisted the leader with lecture notes, sample tests, and any other

material that might help students master the content of the course. The names of students who attended and the number of sessions they attended were monitored by the leader, but the instructor was not informed so as to prevent bias in awarding final grades.

Students in each class took two midterms and a final exam. There were make-up tests available for the two midterms for students receiving less than 70%, with the higher grade establishing the final test grade. The final test grade was the unweighted average of the three test grades calculated in percentage points. The actual test grades are objective and comparable measures of knowledge because they are percentages of correct replies to a sample of questions out of the same pool. Final letter grades were not used in the present study because they also included points for the less objective laboratory reports, homework problems, and an oral report.

For purposes of this study, we assumed that any differences in the distribution of grades between classes with and without SI sessions were due solely to the availability of SI. We computed the respective class averages and tested the significance of the difference by the Mann-Whitney U-test (Siegel, 1956). In addition, we calculated and plotted the distribution of grades. We compared the percentage of the low grades (below 60%) in SI classes to that in non-SI classes and assessed the difference by a Chi-Square test. The same analysis was done for the high grades (above 80%).

For classes with an SI leader, we measured the attendance in SI sessions by means of an "SI Quotient," which is defined as the number of student-hours of attendance divided by the total number of student-hours offered (i.e., the total attendance in SI sessions divided by the product of the number of students in the class multiplied by the number of sessions offered).

Discussion of Results

The average grades of the 14 classes are shown in Table 1.

Table 1. Percentage grades of the classes (on a scale of 0-100 points)

	Day Classes	Evening Classes	All Classes
Non-SI classes (9 classes)	72.8, 55.3, 68.6, 77.6, 59.1, 68.5 Average = 67.0	68.5, 69.4, 68.3 Average = 68.7	67.6
SI classes (5 classes)	71.3, 79.3, 74.3, 76.4 Average = 75.3	69.4 Average = 69.4	74.1

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Table 2. Attendance

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There is considerable variability between the classes. Although it might be expected that day and evening students represent different student populations, there is no striking difference in the grades that the two groups earned. Therefore, results from the day and evening classes were pooled together to test the difference between the average grades in the SI and non-SI classes. The classes with an SI leader had an average grade of 74.1% and those without a leader had an average of 67.6%, a difference of 6.5 percentage points. (These are unweighted averages, since the units compared were whole classes). The difference between the set of average grades of classes with and without an SI leader was tested by means of the Mann-Whitney U test and found it to be significant at a 0.05 confidence level.

As a comparison, we calculated the effect of SI according to the conventional method of measuring success in that program. Within the classes that had an SI leader, grades of students who attended SI sessions were on average 12.0% higher than grades of students who did not attend the sessions (the data leading to this difference are not shown). As stated above, we do not feel that this is an accurate measure of the effect of SI since the students who attended the sessions were self-selected and not randomly assigned.

Table 2. Attendance in SI sessions

	Number of Students		Number of Sessions Offered	Total Attendance*	Avg. No. of Sessions Attended†	SIQ‡
	Attended	Not Attended				
Spring 91	7	6	No Data	No Data	No Data	
Fall 91	12	11	18	100	8.3	0.24
Winter 92	15	5	15	78	5.2	0.26
Spring 92	13	6	18	75	5.8	0.22
Winter 93	12	7	10	38	3.2	0.20

* The sum of the attendance counts for all sessions in quarter.

† Average is the total attendance divided by the number of students who attended SI sessions.

‡ SIQ is the SI quotient, the proportion of student-hours of attendance out of the total student-hours of available SI sessions.

Table 2 shows the attendance in the SI sessions. For the four classes where SI quotients could be calculated, the quotients were 0.20, 0.22, 0.24, and 0.26. This reflects the fact that many students did not attend the sessions, and only a few attended sessions regularly. For instance, a quotient of 0.25 could have resulted if half of the students had ever attended a session, and those who did attend participated in only half of the sessions offered. If we pool together the four

classes for which the SIQ could be computed, we find a total attendance of 291 student-hours out of $(12+11) \cdot 18 + (15+5) \cdot 15 + (13+6) \cdot 18 + (12+7) \cdot 10 = 1246$ student-hours of SI sessions available, yielding an average SIQ of $291 / 1246 = 0.23$. Presumably, if all students had attended all sessions, the improvement of the average grade would be more extensive than that observed. Most of the improvement would have been attained by full attendance of those students who had ever attended sessions, and a small part by the participation of those who had never attended sessions.

Assuming that the increase in the average grade is proportional to the SIQ, we estimate the increase to be $6.5 / 0.23 = 28.3$ percentage points (average observed improvement divided by the average SIQ). This would raise the average grade from 67.6 to an "idealized grade" of 95.9 percentage points. Unfortunately, it is not feasible to test this proportionality assumption by performing regression analysis of the increase in grades versus SIQ on our data because (1) only 4 observations of SIQ are available and (2) they are too close (between 0.20 and 0.26) to permit a reliable fit. Thus, we regard the proportionality assumption to be merely a working hypothesis.

The distribution of grades in classes with and without an SI leader is shown in Figure 1. In classes that had an SI leader there were fewer students who earned low grades (below 60%), and more students who earned high grades (above 80%), compared to classes that had no SI leader. Chi-Square tests on our sample show that in both the high and low groups these differences are statistically significant at a 0.01 confidence level.

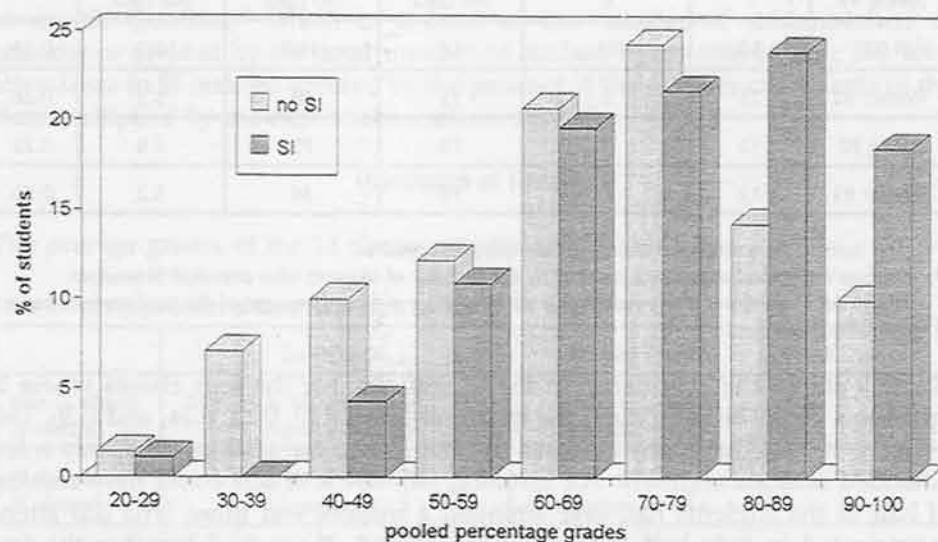


Figure 1. Grade distributions in classes with and without SI leaders

Significance of Results

The difference between grades of whole classes that had an SI leader and those that did not is 6.5 percentage points. If we compare the average grades of students who attended SI sessions with those of students who did not within the same class, we find a larger difference of 12 percentage points. This 12% difference is about twice as much as the improvement of up to about one half a letter grade found by Garland (1987) and NCSI (1994). However, percentage points and letter grades are not unequivocally comparable as the former are more objective. The improvement of the grades of the students who actually attended the SI sessions cannot be completely attributed to the SI leader. Rather, many of these higher grades can be attributed to the interest, motivation, time devoted to studies, and other characteristics of this self-selected group of students who chose to attend the sessions.

Another way of assessing the effect of SI sessions on students' grades is to take into account the attendance in the SI sessions. Blanc, DeBuhr and Martin (1983) showed that the percentage of failures and withdrawals decreases with the increase in percentage of attendance in SI sessions. To take into consideration the variation in the attendance, we looked at the "SI quotient." We assumed as a working hypothesis that the contribution of the SI leader to improving the grades of the students is proportional to SIQ. Under this assumption, and with full attendance of all students in all sessions ($SIQ = 1$), the average grade would have reached a surprising 95.9%. It is unrealistic to expect that any amount of academic support can increase grades to such an extent since this estimate exaggerates the possibilities of improving grades by attending SI sessions. There may be several other factors involved such as the time and effort students themselves invest to bring their grades up to the maximum.

In classes in which an SI leader was available, the number of students receiving grades below 60% decreased; whereas, the number of students receiving grades above 80% increased. This indicates that students can advance from the lower to the medium range of grades as well as from the medium into the upper range. It also shows that even relatively good students attend SI sessions, and it sheds an interesting light on who chooses to attend and who profits from the sessions. Students from all levels of academic potential attend, and practically all benefit to some extent from SI sessions.

There are two limitations of our study. The first is the small number of classes, 14 in all. The second is the typically small class size (approximately 20 students); a greater class size would make the class average more reliable but would hinder the students. Therefore, whereas the results are statistically significant, one can question how much the results can be generalized. We believe that with larger

lecture classes the effect of SI would be even more pronounced. In large classes there is less opportunity for individual attention by the instructor; therefore, the SI session has the potential of greater individual benefit.

Conclusion

Our approach to the assessment of the success of SI sessions avoids the bias of comparing self-selected groups. However, neither our approach of comparing the achievements of classes with and without an SI leader, nor the conventional method of comparing achievement of students who did or did not attend SI sessions, gives a full account of the potential of the SI model of academic support. Our approach reflects the effect of the leader, but certainly underestimates the maximum impact on individual students that may be gained from SI sessions, whereas the conventional approach exaggerates this impact. But both demonstrate considerably high success rates. In view of this conclusion, students should be encouraged to attend in increasing numbers and more regularly.

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