The Relationship of Supplemental Instruction and Final Grades of Students Enrolled in High-Risk Courses

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THE RELATIONSHIP OF SUPPLEMENTAL INSTRUCTION AND FINAL GRADES OF STUDENTS ENROLLED IN HIGH-RISK COURSES

by

Sally A. Pryor

A Dissertation
Submitted to the Faculty of The Graduate College in partial fulfillment of the requirements for the Degree of Doctor of Education Department of Educational Leadership

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THE RELATIONSHIP OF SUPPLEMENTAL INSTRUCTION AND FINAL GRADES OF STUDENTS ENROLLED IN HIGH-RISK COURSES

Sally A. Pryor, Ed.D.
Western Michigan University, 1989

The purpose of this study was to determine if there was a significant relationship between attendance at Supplemental Instruction (SI) and final course grades. This study focused on a program where only undergraduate students led SI sessions. The subjects were 268 students enrolled in three high-risk science courses at a public university in the Midwest during fall semester 1988.

Three research hypotheses were investigated:

1. There is a significant relationship between level of attendance at SI and final course grades.

2. Students who attend SI earn significantly higher final course grades than students who do not attend SI.

3. There is a significant difference in the grade distribution of students who attend SI and students who do not attend SI.

Each hypothesis was tested at the .05 level.

Attendance at Supplemental Instruction was significantly related to final course grades, and students who attended SI earned significantly higher final course grades than students who did not attend SI. There was also a significant difference in the grade distribution of students who attended SI and students who did not attend SI.
This was the first study to follow the stated standards for selecting SI leaders. The findings from this study, where only undergraduate students led SI sessions, confirmed the major conclusion of earlier studies that there is a significant relationship between attendance at SI and final course grades. Since only a limited number of studies have been reported on SI, additional research is needed to identify those elements of the model that are related to student achievement.
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The relationship of Supplemental Instruction and final grades of students enrolled in high-risk courses

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Sally A. Pryor
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CHAPTER I

INTRODUCTION

Overview

Colleges and universities have traditionally provided academic support programs for students (Boylan, 1988). These programs have taken various forms ranging from peer tutoring to comprehensive learning programs taught by faculty in conjunction with academic courses. Studies on academic support programs in the 1980s have emphasized the need to integrate learning strategy with course content (Langer & Neal, 1987; Martin & Blanc, 1981; Maxwell, 1988); this integration is an important characteristic of effective programs (Keimig, 1983).

Supplemental Instruction (SI) is an academic support program designed to integrate review of course content with instruction in learning and study strategies. Staff at the University of Missouri-Kansas City (UMKC) developed the SI model in the late 1970s for use in difficult introductory courses. The United States Department of Education Joint Dissemination Review Panel (JDRP) cited SI as an exemplary program in higher education in 1981 and the National Diffusion Network (NDN) validated the program for dissemination to other colleges and universities (Cartwright, 1987). The JDRP recertified the SI model in 1985 and the NDN again funded the dissemination effort (S. Rubak, personal communication to M. Garland, UMKC, 1
A major feature of the SI model is the integration of course content with learning strategy achieved through the use of undergraduate student leaders. Faculty recommend students as potential SI leaders; once hired, these students participate in training sessions both before and during the semester. The purpose of the training is to teach the SI leaders effective learning and study strategies. SI leaders attend all class sessions and conduct regularly scheduled review sessions throughout the semester to help students develop strategies for learning course material. Information published on the SI model advises campuses interested in implementing the program to select and train "top-notch" students to lead SI sessions (Garland, 1986).

Problem

Supplemental Instruction is a relatively new program. Only limited research is reported on the relationship between attendance at SI and final course grade; these studies differ in their description of the qualifications and training of the SI leader. In the original proposal submitted to the JDRP the program developers identified SI leaders as a "heterogeneous mixture of full-time faculty... graduate students... and undergraduate students" (Cartwright, 1987, p. 10). SI leaders are referred to as learning center specialists, certified as content competent by the faculty teaching the course where SI is offered (Martin & Blanc, 1981). No distinction is made between the results of SI sessions led by full-time professors...
and those led by students.

Three reports document the relationship between SI and final course grades at campuses other than UMKC, where the program was developed (Harrington & Moore, 1986; Simpson, 1986; Wolfe, 1987). Although Harrington and Moore (1986) and Simpson (1986) did not refer to their programs as SI, the programs followed the UMKC model. Wolfe (1987) replicated the SI model and referred to it by that name. In each report SI leaders were professional staff or faculty, not students.

The Supplemental Review leader of the program reported by Harrington and Moore (1986) was the director of the campus learning center. In the Simpson (1986) study, the Supportive Seminar leader was a faculty member who taught study strategies. In the Wolfe (1987) study, the SI leader was the coordinator of reading at the college. Each of these studies found that students who attended review sessions earned higher course grades than students who did not attend. However, each program used professional staff or faculty as SI leaders. The effectiveness of the SI model using trained students to lead SI sessions has not been reported in the literature and is an area for further study.

The research question addressed in this study was: Is there a significant relationship between attendance at SI and final course grades in a program where only undergraduate students led SI sessions.
Definitions

The independent variable in this study was the level of attendance at SI sessions. The dependent variable was the final course grade earned by students.

**Attendance:** Attendance was defined as documented presence at any regularly scheduled SI session. Students who attended SI signed an attendance roster and listed their social security numbers. SI leaders verified student attendance at each session.

**Supplemental Instruction (SI):** SI was defined as a program of academic support for students enrolled in difficult entry-level courses. At SI sessions, students reviewed course material and practiced strategies for taking notes, reading textbook material, and preparing for tests. SI leaders scheduled and conducted three 1-hour review sessions each week throughout the semester. Attendance at SI sessions was voluntary.

**SI Leaders:** SI leaders were students recommended by the faculty member teaching the course and trained to lead SI sessions. SI leaders must have recently taken the course from the cooperating faculty member, earned at least a B in that course, and have an overall grade point average (GPA) of 3.0 on a 4.0 scale. SI leaders were paid to attend class sessions, conduct three 1-hour SI sessions a week throughout the semester, verify student attendance at SI sessions, attend regular training and supervisory meetings (including 8 hours of training before the semester begins), and meet with the SI faculty member as needed.
Course grade: The final course grade recorded on the official transcript. Grades are reported on a 4.0 scale (A = 4.0).

Purpose of the Study

The purpose of this study was to determine if there was a significant relationship between attendance at SI and final course grades in a program where only undergraduate students led SI sessions.

Staff at the University of Missouri-Kansas City first reported a relationship between attendance at SI and final course grades based on a program developed and implemented on that campus (Blanc, DeBuhr, & Martin, 1983; Martin, 1980; Martin & Blanc, 1981). Three reports on the relationship between attendance at SI and final course grade are reported from other campuses; in each report either faculty or staff (not undergraduate students as specified in the model) led the SI sessions (Harrington & Moore, 1986; Simpson, 1986; Wolfe, 1987). The relationship between attendance at SI and final course grade on a campus where only undergraduate students lead SI sessions has not been reported in the literature. The use of students to lead SI sessions reduces the cost of the program and can be a consideration for other campuses interested in implementing the SI model.

Hypotheses

Three research hypotheses were investigated in this study:

1. There is a significant relationship between level of attendance at SI and final course grades.
2. Students who attend SI earn significantly higher final course grades than students who do not attend SI.

3. There is a significant difference in the grade distribution of students who attend SI and students who do not attend SI.

Conceptual Framework

The Supplemental Instruction model combined elements of two traditional forms of academic support: peer tutoring and study skills instruction. Peer tutoring refers to situations in which students teach other students; the focus is typically on content. Peer tutors are usually selected for their mastery of the subject matter. Instruction in study skills focuses on specific learning strategies designed to help students improve their skills in time management, note-taking, test-taking, concentration and memory, listening, and effective reading strategies (Enright, 1975). Study skills strategies are often presented in noncredit workshops or seminars. Both peer tutoring and study skills instruction are related to improved achievement; however, they lack the purposeful integration of content and strategy characteristic of effective academic support programs (Keimig, 1983).

Since the mid-1970s, researchers have reported that the integration of course content with learning and study strategies is related to increased course performance. Martin and Blanc (1981) reported that although students typically perceived their needs as totally content-centered, many of them actually lacked the prerequisite learning skills needed for content mastery. Hubin (1976) reported
that students who were doing poorly in a specific course tended to seek help for that course, but did not seek help in ways to improve their study skills. The grade point average of students who received tutoring was below the campus norm, while the grade point average of students who attended the Reading and Study Skills Lab was well above the campus norm. Students tended to seek short-term solutions to their academic problems. Teaching study skills with course content improves academic performance and is an effective means of promoting student success (Langer & Neal, 1987).

Academic support programs can be classified according to their level of integration with course content and evaluated by their relationship to final course grade (Keimig, 1983). The Keimig model divided academic support programs into four levels of effectiveness. Isolated remedial skills courses were characterized as least effective, followed by peer tutoring. Programs which integrated course content with learning strategy were at a higher level followed by comprehensive learning programs taught in academic courses. Supplemental Instruction, which integrates course content with learning strategy, is more effective than either isolated skills instruction or peer tutoring according to this model (Maxwell, 1988).

The SI program differs from other forms of academic support in its emphasis on high-risk courses rather than high-risk students. The program developers defined high-risk courses as traditionally difficult, entry-level courses in which approximately 30% or more of the students earned a final course grade below a C or withdrew from the course (Blanc et al., 1983). Actual reports of the program's
relationship to final course grades are limited.

Three studies were reported from the University of Missouri-Kansas City (Blanc et al., 1983; Martin, 1980; Martin & Blanc, 1981). Three additional studies were reported from other campuses (Harrington & Moore, 1986; Simpson, 1986; Wolfe, 1987). The programs reported from these other campuses all differed from the stated standards for selecting SI leaders; faculty or professional staff, rather than undergraduate students, led the SI sessions. The findings from these programs may be different from those where only undergraduate students led SI sessions.

Blanc et al. (1983) referred to the possible effects of staffing SI with professional, experienced staff members. In commenting on the relationship between the reduction in the rates of grades below a C and the level of participation in SI they reported:

Although comprehensive analysis of these data have not been completed... the SI leader during 1978 and 1979 was a full-time staff member with considerable teaching and SI experience. In contrast, the SI leader during 1980 was a graduate intern conducting SI for the first time. (p. 87)

No further reference to the difference in findings based on the qualifications of the SI leader was reported in this or other studies.

Importance of the Study

Academic support programs that integrate course content with learning and study strategies are more effective than either course tutoring or isolated study skills courses in increasing final grades and retention rates (Keimig, 1983). SI integrates both content and strategy. Undergraduate students, selected for their mastery of
course material and trained in learning and study strategies, lead SI sessions. The use of undergraduate students, rather than faculty or professional staff, reduces the cost of the program and is often a consideration for other campuses interested in implementing the model.

The purpose of this study was to determine if there was a significant relationship between attendance at SI and final course grades. Unlike other studies of the SI model reported in the literature (Harrington & Moore, 1986; Simpson, 1986; Wolfe, 1987), this program used only undergraduate students to lead the SI sessions as specified in the NDN standards for selecting SI leaders. Staffing is an aspect of the program not studied by other researchers.

Assumptions

In this study, attendance was defined as documented presence at any regularly scheduled SI session. The actual level of participation was not measured. Since attendance was optional, it was assumed that students who attended SI participated in discussions and activities designed to integrate course content review with effective study strategies.

Limitations of the Study

This study was limited to an SI program offered at one public university in the Midwest. On-campus undergraduate enrollment during fall semester 1988 was approximately 18,000. The subjects of the study were students enrolled in three 100-level science courses during fall semester 1988. Only students who agreed to participate
in the study were included in the analysis. A control group was neither planned nor identified; all students enrolled in the three courses had the opportunity to participate in the program.

SI is offered only in those courses where faculty support the program. Faculty who agree to participate in this type of program may be different from faculty who opt not to participate. In this study, 12 professors scheduled to teach high-risk, 100-level courses during fall 1988 were contacted and invited to participate in the SI program. Since a mathematics tutoring program was in place, faculty teaching these courses were not contacted. Four faculty responded; all four were tenured professors in the College of Arts and Science teaching introductory science courses; consequently, this study was limited to students enrolled in 100-level science courses taught by tenured faculty members. Three of the four professors had taught the course during the past academic year and recommended possible SI leaders. The fourth professor had not taught the course in the past academic year and was not able to recommend a student who had taken the course from him; this course was eliminated from the analysis.

This study was designed to determine if there was a significant relationship between attendance at SI and final course grades. The study focused on one program which followed the undergraduate staffing model. The findings from this study were not intended to be generalized to other populations, but to add to the limited research reported on the SI model. The relationship between attendance at SI and final grades in a program where only undergraduate students lead SI sessions has not been previously reported.
CHAPTER II

REVIEW OF THE LITERATURE

Overview

The purpose of this study was to determine if there was a significant relationship between attendance at Supplemental Instruction (SI) and final course grades on a campus where only undergraduate students led SI sessions. This review of the literature is divided into two sections. The first section includes an overview of academic support programs in higher education with specific reference to their historical development, peer tutoring programs, and study skills instruction. The second section includes a description of the SI program, SI leaders, and attendance patterns. A review of the published reports on SI programs at the University of Missouri-Kansas City where the program was developed and three other campuses concludes the chapter.

Academic Support Programs

History

Academic support programs are not a new phenomenon in American higher education. In 1889, approximately 80% of all colleges and universities offered some type of academic support for students; in 1988, the percentage was approximately the same (Boylan, 1988). The
types of programs offered for students varied.

Colleges and universities have historically admitted students who needed various forms of academic assistance to complete college level course work. In 1874 Harvard first offered "Freshman English" at the request of faculty members concerned about their students' level of competency; in 1907 over half of the students who matriculated at Harvard, Yale, Princeton, and Columbia failed to meet entrance requirements in place at the time (Brubacher & Willis, 1976). Admission to a university was no guarantee of success. Most institutions developed programs to help underprepared students succeed.

In the late nineteenth century student tuition and fees were the major source of revenue for colleges and universities; the only admission requirement was the student's ability to pay (Boylan, 1988). Free secondary education was not available to all students (Brubacher & Rudy, cited in Boylan, 1988). As a result, many students who entered college lacked the prerequisite skills necessary to succeed. Colleges developed preparatory programs to address this need. By 1889, 80% of U.S. colleges and universities had established some form of college preparatory programs (Canfield, cited in Boylan, 1988).

Junior colleges emerged in the early part of the twentieth century and provided an alternative to the college preparatory program. Students were able to enroll in junior colleges and complete the first two years of a college program as well as the remedial or developmental courses they needed. By the 1940s college preparatory programs had been largely replaced in American higher education by junior colleges and by college divisions within universities;
however, academic support programs still existed in varying forms on
four-year college campuses (Boylan, 1988).

In 1944 Congress enacted the Veteran's Adjustment Act. Colleges
and universities began to offer a variety of study skills workshops
and individualized tutorial programs to help veterans succeed in
their course work (Boylan, 1988). Academic support programs during
the 1940s and 1950s focused on strategies to meet the needs of this
new type of student.

Specific demographic and economic events of the 1960s combined
to produce a change in the type and number of students entering
American colleges and universities. The children of the post-World
War II "baby boom" were of college age and greatly increased the pool
of students applying for college admission. For the first time,
American colleges and universities were able to be highly selective
in their admissions practices (Boylan, 1988). Given the number of
potential applicants, attrition was not an issue.

In 1964 Congress funded the Upward Bound Program. The goal of
the program was to encourage large numbers of disadvantaged minority
students to prepare for college. In 1965 Congress passed the Higher
Education Act. Federal funds were available to recruit minority
students and to offer programs to help them succeed. This legisla-
tion resulted in an expansion in the type and number of academic
support programs offered for students.

The number of students seeking admission to colleges and univer-
sities declined during the 1970s, resulting in policies of open
admissions on many campuses. By 1970 one-half million students,
one-seventh of them enrolled in colleges and universities, came from poverty backgrounds (Brubacher & Willis, 1976). These students often lacked the skills necessary to be successful in a college program. The development of programs to assist these students became increasingly important.

Demographers report that the number of students graduating from high school will continue to decline through 1998 (Hodgkinson, 1983). This decline will occur primarily among white middle-class students; any surge in new enrollments during the 1990s will be from either minority or nontraditional groups. Colleges and universities will need to provide academic support for these students to help them succeed (Hodgkinson, 1983).

Many students come to college thinking they have the skills needed to succeed, only to soon experience difficulty with their course work. The average high school student graduates with better than a B average, yet reads below the eighth grade level (Roueche, Baker, & Roueche, 1984). A large proportion of college freshmen function at the preformal operational level of thinking as described by Piaget, and are unable to operate at the formal, more abstract level of thinking often expected by college professors (McKinnon & Renner, 1971). The inability to operate at a more abstract level of thinking can be a problem for freshmen enrolled in introductory science courses (Collea, 1981). Without some type of assistance, many freshmen are not able to compete academically and become part of the "revolving door" syndrome in higher education (Donovan, 1975).
Unlike the 1960s when there were more students interested in entering colleges than could be admitted, the number of potential students is expected to decrease throughout the 1990s (Hodgkinson, 1983). Each student leaving a university before graduation means a loss of revenue. Programs that can document their relationship to increased levels of achievement will become important as colleges and universities prepare to meet the challenges of the 1990s.

Peer Tutoring Programs

The term peer tutoring refers to situations in which students teach other students. The concept of peer tutoring is not new; Aristotle used peer tutors to help students prepare for responsible citizenship in the Greek state (Deming, 1986). In the Middle Ages, the wealthy often hired tutors to assist their children with their university studies (Maxwell, 1979).

Peer tutoring in American education dates back to the one-room schoolhouse. In higher education, professors and graduate students often helped younger students prepare for examinations. Woodrow Wilson, when president of Princeton, introduced preceptors (typically graduate students) to establish informal associations with undergraduates and guide their studies (Maxwell, 1979).

Tutoring was historically available for students who could afford to pay for it; a major change in this practice occurred in American higher education in the 1960s. As increasing numbers of low-income and disadvantaged students matriculated, colleges and universities developed tutoring programs to help them succeed.
Tutoring, once contracted for on a private basis, became institutionalized. By the 1970s learning centers developed on many campuses combining tutorial services for disadvantaged students with reading and study skills programs (Maxwell, 1979).

Johnson and Johnson (1975), in their research on cooperative learning, reviewed the literature on peer tutoring and found it to have distinct advantages for both the students being tutored and the tutor. Researchers in higher education have reported the success of peer tutoring in both the cognitive and affective realms. Irwin (1980) and Oestereicher (1987) both conducted studies which found that student grades and attitudes improved after one semester of tutoring.

**Study Skills Programs**

Educators in the early twentieth century developed courses to help students improve their study skills (Maxwell, 1979). In 1926 the University of Buffalo developed a 3-week summer skills course for underachieving students; admission to the university was contingent upon successful completion of the course (Enright, 1975). Topics taught in these early academic support programs were similar to those covered in the late 1980s: reading, listening, note-taking, library skills, and concentration (Enright, 1975; Kulick, Kulick, & Shwalb, 1983). Faculty or learning center staff rather than undergraduates usually conducted study skills programs. However, researchers in the mid-1970s began to report the effectiveness of using advanced undergraduates to tutor students in study strategies (Fremouw & Feindler, 1978; Jackson & VanZoost, 1974).
A major criticism of study skills programs taught in isolation was the inability of students to transfer study skills to their course work (Sheets & Rings, 1989). Adjunct courses eliminated some of the problems associated with study skills programs. The purpose of adjunct courses was to help students develop and apply effective learning and study skills to specific course content (Harding, 1981). Adjunct courses can take various forms, but usually are taught by a faculty member or a learning center staff person. Depending on the structure of the program, the course may be offered for credit. The effectiveness of these courses can be measured on the basis of the final grade earned by students in the content course. Tomlinson and Green (1976) reported that biology students in an adjunct course earned almost a full letter grade higher than students in the control group, or the difference between a low B and a C. Erlich and Kennedy (1983) and Harding (1981) also reported positive findings from adjunct courses, but did not report specific grade differences between participants and nonparticipants.

The Learning to Learn (LTL) Thinking Improvement System (Heiman & Slomianko, 1987) is often taught as an adjunct course. LTL is designed to help students develop skills in both learning and thinking that they can apply to other course work. The U.S. Department of Education approved the LTL system in the fall of 1983. The goal of the program is to teach students to become active learners. The authors distinguish the program from other types of study skills instruction:
Learning to Learn is not a study skills system. When students stop actively using most study skills, the skills lose their effectiveness. In contrast, when students master the Learning to Learn System, they can stop doing the exercises and still perform well academically: we are teaching people to think. Once the behavior is well established...the process of learning how to learn has been internalized. (Heiman & Slomianko, 1987, p. 7)

The LTL program can also be presented in a course in critical thinking, as a freshman year experience course, as a 3-credit elective course, in a college learning center, or in a content course (Heiman & Slomianko, 1987, p. 4). The program developers provided data to the JDRP which demonstrated the relationship between participation in the program and improvement in grade point averages, credits completed per semester, and retention in college through graduation (Heiman & Slomianko, 1987).

The need to identify academic support programs that have a direct relationship to student performance is and will be an important issue in higher education. Many researchers report considerable success with programs that incorporate study skills instruction with course content review (Erlich & Kennedy, 1983; Heiman & Slomianko, 1987; Main, 1980; Martin & Blanc, 1981; Maxwell, 1988; Tomlinson & Green, 1976). Instead of just learning about strategies, students actually apply these techniques to the courses they are studying. Student learning is more effective because there is some structure around which materials and ideas can be organized (Main, 1980).

Final course grade is one measure that can demonstrate the relationship between learning support and academic achievement (Boylan, 1981; Brown, 1980). Evaluation based on course grade point average
(GPA) limits studies to one semester; however, the effectiveness of promising academic support programs can be completed in this time frame (Astin, 1975).

Supplemental Instruction

Program Description

Supplemental Instruction was first developed at the University of Missouri-Kansas City to reduce the attrition rate of minority students enrolled in introductory-level science courses. The program was funded entirely by the institution and did not rely on any federal funding sources (Cartwright, 1987). SI was designed to help students master course content while at the same time increase their learning and study skills (Blanc et al., 1983). One of the main features of SI is its emphasis on increasing student achievement and reducing attrition without relaxing academic standards (Martin & Blanc, 1981).

SI is based on the assumption that students perceive their need for support as content-related, while, in fact, they often lack the basic learning and thinking skills necessary to successfully complete the course work (Blanc et al., 1983). SI attempts to teach learning and study skills within the context of high-risk courses. Unlike some remedial and developmental courses, SI seeks to improve the learning and retention of students in the regular academic program and is a cost-effective method of increasing both learning and retention (Maxwell, 1988).
SI follows a predict-and-verify format: Students participating in the program are encouraged to develop a framework for the course and to predict the direction of future lectures and readings (Martin & Blanc, 1981). SI leaders receive specific training in how to incorporate study skills instruction with course content review.

Program Leaders

SI leaders are students who have previously taken the course and have been certified as content competent by the cooperating faculty member. SI leaders must have an overall GPA of 3.0 on a 4.0 scale (Garland, 1986). The SI leaders are presented to the students in the class as model students, not as teachers or teaching assistants. Job responsibilities are to attend lectures, take notes, and read assignments; SI leaders typically conduct three 1-hour review sessions each week throughout the semester to help students review lecture notes, vocabulary, difficult concepts, and possible test questions.

Six reports on the SI model are reported in the literature; the most extensive reports were written by the program developers at UMKC (Blanc et al., 1983; Martin, 1980; Martin & Blanc, 1981). An important variable not addressed in these reports is the qualifications of the SI leader. The original research refers to SI leaders as "Student Learning Center specialists who had been certified as content competent by the professor of the course" (Martin & Blanc, 1981, p. 2). No additional information is given on the qualifications of the SI leaders. In another study reported on the program at UMKC, Blanc et al. (1983) briefly referred to the possible effects of
staffing SI with experienced professional staff members rather than inexperienced graduate students; however, no further reference to the difference in results based on the qualifications of the SI leader is reported.

Reports from other campuses included reference to the use of undergraduate students as SI leaders but described actual grade differences from programs where professional staff or faculty, not students, led the SI sessions (Harrington & Moore, 1986; Wolfe, 1987). The use of undergraduate students to lead SI sessions is an important component of the SI model. The effectiveness of this staffing pattern on other campuses has not been reported. The findings from programs where faculty or professional staff led SI sessions may be different from findings where students led SI sessions.

Program Attendance

Reports on attendance at SI programs vary. Blanc et al. (1983) found that attendance ranged from 1 to 25 hours and averaged 6.5 hours per semester; class attendance increased from 13% in 1978 to 45% in 1980. Wolfe (1987) reported that 46% of the class used the service; attendance ranged from 1 to 27 sessions with an average of 3.3 sessions per student; Harrington and Moore (1986) reported that 21% of the class attended SI; average attendance was 7.6 hours per student. In these three reports, all students who attended SI were included in the analysis of the relationship between attendance at SI and final course grade.
Program Findings at UMKC

Martin and Blanc (1981) reported on the findings of an SI program offered in a high-risk introductory American history course over two consecutive semesters (n = 225; n = 202). Students who attended SI earned a greater percentage of Bs and Cs than nonparticipants in both semesters of the study. In the second semester, when participation increased from 13% of the class to 36%, SI participants also earned a higher percentage of As than nonparticipants. In both semesters the percentage of students earning below a C was greater for the non-SI group than for the SI group. During the first semester of the program, 14.7% of the SI group earned below a C as compared to 39.8% of the non-SI group; during the second semester, 21.7% of the SI group earned below a C as compared to 42.4% of the non-SI group. The percentage of students earning below a C or withdrawing from the course for the non-SI group was consistent with the rate of unsuccessful enrollments (40.2%) reported for the same course taught by the same professor the year before SI was introduced.

Additional research on the program at UMKC (Blanc, et al., 1983) found that the final course grade of SI participants enrolled in seven courses in the College of Arts and Sciences during one semester (n = 746) was higher than the final course grade of nonparticipants. The researchers expanded the previous study by examining the grades of participants and nonparticipants as well as a motivational control group. The motivational control group consisted of students who expressed a high interest in attending SI sessions, but who were
unable to attend because of conflicts with work and other courses.

In this study the average course grade for the 261 SI participants was 2.50; the average course grade for the 132 students in the motivational control group was 2.12; the average course grade of the other 353 students was 1.57. These differences were significant at the .01 alpha level using a t test (Blanc et al., 1983, p. 84). A significant association between the relative frequencies of students earning below a C was also found (.05 using a chi-square test). The high school rank of the three groups was equivalent. The frequencies, converted to percentages, were 18.4% for the SI group compared to 26.5% for the motivational control group and 44.0% for all others.

Program Findings on Other Campuses

Similar findings were reported from the University of Nebraska at Omaha. Supplemental Review (SR) sessions, based on the SI model, were offered in five Spanish 111 classes during fall semester 1982. The director of the college learning center led the sessions. The SR group (n = 20) earned a higher percentage of As, Bs, and Cs than did the non-SR group: 35% versus 29% (As), 25% versus 23% (Bs), and 35% versus 10% (Cs); only one of the students in the SR group earned below a C (5%), while 29 students (38%) in the non-SR group earned below a C or withdrew from the course (Harrington & Moore, 1986).

The findings of a voluntary adjunct program modeled on SI were reported from the University of Georgia (Athens, Georgia). Supplemental Seminars (SS) were conducted for students enrolled in a general education elective course, Introduction to Psychology (n = 161).
The purpose of the seminars was to teach students study strategies that could be applied to that course. The SS leader was a faculty member. Students who attended 3 or more of the 16 sessions offered during the semester were considered SS participants \((n = 46)\). Students who did not attend any sessions were considered non-SS participants \((n = 95)\). Students who participated in the SS earned an average course grade of 6.76 (on a 12-point grading scale) as compared to 4.79 for the non-SS group, a significant difference favoring the SS participants \(t(139) = 3.54, p = .0005\) (Simpson, 1986, p. 66).

Similar findings were reported from a pilot SI program conducted in an American history course offered during fall semester 1986 at Anne Arundel Community College in Arnold, Maryland. The SI leader was an English professor and coordinator of the reading department at the college. The findings from this program showed a difference in the final course grade of the SI and non-SI groups. The average grade of the SI group was 2.5; the average grade of the non-SI group was 1.6 (4-point scale). Results were significant at the .01 level (Wolfe, 1987). A difference was also reported in the rate of Ds, Fs, and Ws earned by students: 16% for the SI group as compared to 55% for the non-SI group. These findings for the combined D/F/W rate versus all others were significant at the .001 level.

The staff at the University of Missouri-Kansas City have trained people from over 100 campuses to implement and evaluate the SI program (Maxwell, 1988). Several journal authors cite SI as an effective model of academic support for students (Beal, 1980; Maxwell, 1988; Moore & Carpenter, 1985). However, only three studies have
documented the relationship between attendance at SI and final course grade on other campuses. In each of these programs, the SI leader was a faculty or staff person, not an undergraduate student. The need to document the findings of a program where trained undergraduate students lead SI sessions remains an area for investigation.

Summary

Although colleges and universities have traditionally offered academic support programs to help students succeed, these programs have varied in both form and delivery. The development of these programs paralleled economic, social, and demographic developments in the history of the United States. The SI model is an outgrowth of academic support programs that preceded it in American higher education. The program combines features of both peer tutoring and study skills instruction, but differs from both in its integration of learning strategy and course content.

In the mid 1970s learning center staff at the University of Missouri-Kansas City developed the Supplemental Instruction model. The goal of the program was to reduce the attrition rate among minority students enrolled in preprofessional science courses (Martin, 1980). The model differed from peer tutoring and study skills instruction in its integration of content and strategy. Reports on the SI model documented the relationship between attendance and final course grade (Blanc et al, 1983; Martin, 1980; Martin & Blanc, 1981). The U.S. Department of Education cited SI as an exemplary program in higher education, and the National Diffusion Network

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funded dissemination of the program to other colleges and universities (Cartwright, 1987).

Research on the relationship of attendance at SI and final course grade on other campuses is limited. Harrington and Moore (1986), Simpson (1986), and Wolfe (1987) all reported a difference in the final course grade of students who attended review sessions; however, each program differed from the NDN model in the use of faculty or staff rather than undergraduate students to lead SI sessions. The relationship between SI and final course grade on a campus where only undergraduate students led SI sessions has not been reported in the literature and was the basis for this study.
CHAPTER III

METHODS

Overview

The purpose of this study was to determine if there was a significant relationship between attendance at SI and final course grades in a program where only undergraduate students led SI sessions. A control group was neither planned nor identified; all students enrolled in the three courses where SI was offered had the opportunity to participate in the program. The findings from this study were not intended to be generalized to other populations, but to add to the research reported on the SI model.

Research Design

Hypotheses

Three research hypotheses were studied:

1. There is a significant relationship between level of attendance at SI and final course grades.

2. Students who attend SI earn significantly higher final course grades than students who do not attend SI.

3. There is a significant difference in the grade distribution of students who attend SI and students who do not attend SI.
In each hypothesis the dependent variable was the final course grades earned by students. Final grades were reported on a 4-point scale:

- A = 4.0
- BA = 3.5
- B = 3.0
- CB = 2.5
- C = 2.0

- DC = 1.5
- D = 1.0
- E = 0.0
- X = 0.0 (Unofficial withdrawal)
- W = Official withdrawal

Students who received an Incomplete in the course were excluded from the analysis.

In the third hypothesis, the dependent variable was categorized into grades of 2.0 or above and grades below a 2.0 and withdrawals, the criterion used to identify high-risk courses.

The independent variable in the first hypothesis was attendance at SI. Attendance was defined as the number of SI sessions a student attended during the semester. The range was 1-30.

The independent variable in the second and third hypotheses was also attendance at SI; however, in these hypotheses attendance was defined dichotomously: Students who attended one or more sessions were included in the SI group; students who attended no sessions were included in the non-SI group.

Course Selection

Institutional records were used to identify 100-level courses in which approximately 30% or more of the students enrolled in previous semesters earned below a C or withdrew from the course. This
procedure followed the criterion established in the SI model for the identification of high risk courses (Blanc et al., 1983). Twelve faculty members scheduled to teach these high risk courses during fall 1988 were asked to participate in the program. Faculty in the Mathematics Department were excluded since a tutoring program was available for students in those courses.

Four faculty members teaching 100-level courses agreed to offer SI to their students; all four were tenured professors in the College of Arts and Sciences. Three of the four professors had taught the course during the previous academic year and recommended possible SI leaders. The fourth professor had not taught the course in the previous academic year and was not able to recommend an SI leader who had taken the course from him; this course was excluded from the analysis.

Course Descriptions

Three courses were included in the study: an animal biology course, a plant biology course, and a physics course. Both biology courses are required for students majoring in biology or biomedical sciences and for students in a secondary education curriculum with a biology minor. The physics course is not required for majors, but is recommended for students in curricula other than science and for students desiring a noncalculus course in physics. Students may use the credit earned in any one of these courses as part of the university's general education requirement in natural sciences and mathematics.
Subjects

Two hundred seventy-one of the 360 students (75%) enrolled in the three courses agreed to participate in the study. Three of these students were enrolled in more than one of the courses and were excluded from the analysis to maintain the independence of the groups. Two hundred sixty-eight students were included in the study.

The animal biology course (Biology 1) had the largest enrollment, 165 students; 83% of the students were freshmen and sophomores. Enrollments in the plant biology course (Biology 2) and the introductory physics course (Physics) were comparable, 54 and 49 students, respectively. Seventy-four percent of the students in Biology 2 were freshmen and sophomores; 49% of the students in Physics were freshmen and sophomores (see Table 1).

Procedures

SI Leader Selection and Training

SI leaders recommended by the cooperating faculty members were hired before the semester began. All three SI leaders were undergraduate females who had recently taken the course from the professor and earned 4.0 (A) in the course; each had a cumulative grade point average (GPA) above 3.5. None of the SI leaders had worked with the program in previous semesters.

The researcher (trained as an SI supervisor by UMKC staff) conducted the initial 8-hour training program using the materials provided by the program developers at UMKC. Topics covered during
### Table 1

**Characteristics of Participating and Nonparticipating Subjects**

<table>
<thead>
<tr>
<th></th>
<th>Total (n = 268)</th>
<th>Biology 1 (n = 165)</th>
<th>Biology 2 (n = 54)</th>
<th>Physics (n = 49)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n %</td>
<td>n %</td>
<td>n %</td>
<td>n %</td>
</tr>
<tr>
<td>Male</td>
<td>127 47</td>
<td>68 41</td>
<td>25 46</td>
<td>34 69</td>
</tr>
<tr>
<td>Female</td>
<td>138 52</td>
<td>95 58</td>
<td>29 54</td>
<td>14 29</td>
</tr>
<tr>
<td>Freshmen</td>
<td>120 45</td>
<td>90 55</td>
<td>23 43</td>
<td>7 14</td>
</tr>
<tr>
<td>Sophomore</td>
<td>81 30</td>
<td>47 29</td>
<td>17 32</td>
<td>17 35</td>
</tr>
<tr>
<td>Junior</td>
<td>44 16</td>
<td>17 10</td>
<td>13 24</td>
<td>14 29</td>
</tr>
<tr>
<td>Senior</td>
<td>13 5</td>
<td>4 2</td>
<td>1 2</td>
<td>8 16</td>
</tr>
<tr>
<td>Minority</td>
<td>11 4</td>
<td>8 5</td>
<td>1 2</td>
<td>2 4</td>
</tr>
<tr>
<td>Nonminority</td>
<td>227 85</td>
<td>140 85</td>
<td>45 83</td>
<td>42 86</td>
</tr>
<tr>
<td>Mean composite ACT</td>
<td>21.3</td>
<td>21</td>
<td>21</td>
<td>22</td>
</tr>
</tbody>
</table>

**Note.** Discrepancies in totals due to missing data.

The first half-day program included: (a) an overview of the SI model, (b) job description and responsibilities, (c) class presentations and scheduling SI, (d) SI strategies: informal quizzes and syllabus review, (e) room arrangement, and (f) attendance records.

During the second half-day program, basic strategies for taking lecture notes and preparing for tests were presented. SI leaders then attended two lectures given by campus faculty. Following each lecture, the SI leaders participated in simulated SI sessions in which
the researcher acted as the SI leader. Following each simulation, the group discussed specific SI strategies modeled in the simulation.

SI leaders attended six additional one-hour training sessions during the semester. Topics presented at these sessions included: (a) vocabulary development, (b) information mapping, (c) reading a college textbook, (d) note-taking from lecture and text material, (e) preparing for objective and essay examinations, and (f) conducting a post-examination survey.

Each SI leader was observed four times during the semester by the researcher and a graduate assistant working with the program. SI leaders received feedback after each observation and set goals for future sessions.

Program Implementation

During the first week of the semester, the SI leader and the researcher made short presentations to students in each SI course. The researcher introduced the SI leader as a student who had previously taken the course and would be available to help students review course material. SI leaders explained their role in the program. Students in each class completed registration forms, a consent form (if they agreed to participate in the research study), and a schedule listing times when they would be most likely to attend SI sessions (see Appendix C).

SI leaders scheduled three 1-hour review sessions each week. SI leaders distributed a copy of the SI schedule to students in each class and reminded students about SI throughout the semester using
both flyers and short announcements. SI sessions began the second week of the semester and continued until the week before final examinations (13 weeks).

SI leaders were available to meet with students at the scheduled times throughout the semester. During each review session, the leaders helped students review lecture and textbook material. As specified in the SI model, the emphasis was on group review; the SI leader facilitated discussion and clarified material; active participation was encouraged. SI leaders incorporated the study strategies presented during training in their weekly sessions and submitted reports listing strategies used at each session.

Data Collection and Recording

Students signed an attendance roster at each SI session listing their names and social security numbers. SI leaders verified student attendance and submitted these forms to the researcher on a biweekly basis along with their time sheets. A data entry operator recorded student attendance throughout the semester and the final course grade for each student at the end of the semester.

Data Analysis

At the end of the semester a data base was created including the following information about each participant: (a) course identification number, (b) last four digits of the social security number, (c) number of SI sessions attended, (d) final course grade, (e) composite ACT score, (f) sex, (g) classification (freshman, sophomore, junior,
or senior), and (h) race.

A preliminary analysis was completed to determine if there was a significant relationship between variables other than SI and final course grade, including composite ACT score, sex, classification, race, and course.

Testing of the Hypotheses

The Pearson product-moment correlation was used to test the relationship between level of attendance at SI and final course grades (Hypothesis 1). An analysis of variance was used to test the difference in means between students who attended SI and students who did not attend SI (Hypothesis 2). A chi-square procedure was used to test the independence of proportions of students in the SI group and students in the non-SI group who earned a 2.0 or above or below a 2.0 or W (Hypothesis 3). SPSSX (1989) and SAS (1985) were the software packages used to analyze the data.

Each hypothesis was restated in the null form to allow for testing. Since a consistent level of significance was not reported in other studies on SI, the alpha level was set at .05 following the usual practice in educational research (Borg & Gall, 1983, p. 380).

Hypothesis 1: The Pearson product-moment correlation between attendance at SI and final course grades is equal to zero.

Hypothesis 2: The mean final course grades of students who attend SI is equal to the mean final course grades of students who do not attend SI.
Hypothesis 3: The proportion of SI students who earn a 2.0 or above in the course equals the proportion of non-SI students who earn a 2.0 or above in the course; the proportion of SI students who earn below a 2.0 or withdraw from the course equals the proportion of non-SI students who earn below a 2.0 or withdraw from the course.

Limitations

This study was conducted at one public university during one semester. The purpose of the study was to add to the research published on the SI model where only undergraduates led SI sessions. Characteristics of the SI model, specifically voluntary attendance and faculty cooperation, pose certain threats to the internal validity of the study. Faculty and students who agree to participate in SI may be different from faculty and students who choose not to participate.

A control group was neither planned nor identified. Although all the courses were high-risk courses on this campus, no attempt was made to control for other differences among them. The findings from this study were not intended to be generalized to other populations. Readers should be aware of these limitations.

Summary

The purpose of this study was to determine if there was a significant relationship between attendance at SI and final course grades in a program where only undergraduate students led SI sessions. Three research hypotheses were studied:
1. There is a significant relationship between level of attendance at SI and final course grades.

2. Students who attend SI earn significantly higher final course grades than students who do not attend SI.

3. There is a significant difference in the grade distribution of students who attend SI and students who do not attend SI.

The findings from this study were not intended to be generalized to the other populations, but to provide information on the SI model on a campus where undergraduate students led SI sessions.
CHAPTER IV

FINDINGS

Descriptive Data

Ninety-two of the 268 students (34%) enrolled in the three courses attended SI during the semester. Attendance ranged from 1-30 sessions and averaged 4.5 hours per participant. Students were initially categorized into two groups for descriptive purposes: those who attended one or more sessions (SI group) and those who attended no sessions (non-SI group). See Table 2.

Preliminary Analysis

Preliminary testing was completed to determine if there was a significant relationship between variables other than SI and final course grade, including composite ACT, sex, classification, race, and course. A significant relationship was found between final course grade and composite ACT ($r = .4725, p = .000$). A $t$ test for independent means found a significant difference in the composite ACT scores of students who attended SI and students who did not attend SI ($p = .003$). Based on these findings, the composite ACT score was used as a covariate in subsequent analyses.

An analysis of variance showed no significant difference in final course grade based on sex, class, and race ($p > .05$). Both class and race were recoded to complete the analysis: freshman,
Table 2

Characteristics of SI Group and Non-SI Group

<table>
<thead>
<tr>
<th></th>
<th>SI group (n = 92)</th>
<th>Non-SI group (n = 176)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Female</td>
<td>48</td>
<td>52</td>
</tr>
<tr>
<td>Male</td>
<td>44</td>
<td>48</td>
</tr>
<tr>
<td>Freshman</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>Sophomore</td>
<td>29</td>
<td>32</td>
</tr>
<tr>
<td>Junior</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Senior</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Minority</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Nonminority</td>
<td>74</td>
<td>80</td>
</tr>
<tr>
<td>Mean composite ACT (Standard deviation)</td>
<td>20 (5.38)</td>
<td>22 (4.21)</td>
</tr>
</tbody>
</table>

sophomore (Level 1); junior, senior (Level 2); Black, Hispanic, and American Indian (minority); White (nonminority). See Table 3.

Further analysis was completed to determine if the specific course (COURSEID) was a factor in determining final course grade (see Table 4). Attendance (ATTD) was recoded into four categories to refine the analysis: attended no sessions; attended 1-2 sessions; attended 3-6 sessions; attended 7 or more sessions. An analysis of variance using course identification and attendance as factors determined that course identification was not a factor in determining
Table 3
Analysis of Variance: Final Course Grade by Sex, Class, and Race

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACT</td>
<td>22.870</td>
<td>1</td>
<td>22.870</td>
<td>31.719</td>
<td>.000</td>
</tr>
<tr>
<td>Main effects</td>
<td>0.450</td>
<td>3</td>
<td>0.150</td>
<td>0.208</td>
<td>.891</td>
</tr>
<tr>
<td>SEX</td>
<td>0.030</td>
<td>1</td>
<td>0.030</td>
<td>0.041</td>
<td>.839</td>
</tr>
<tr>
<td>CLASS</td>
<td>0.418</td>
<td>1</td>
<td>0.418</td>
<td>0.579</td>
<td>.448</td>
</tr>
<tr>
<td>RACE</td>
<td>0.006</td>
<td>1</td>
<td>0.006</td>
<td>0.008</td>
<td>.930</td>
</tr>
<tr>
<td>Explained</td>
<td>23.320</td>
<td>4</td>
<td>5.830</td>
<td>8.086</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>89.405</td>
<td>124</td>
<td>0.721</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>112.725</td>
<td>128</td>
<td>0.831</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. 268 cases were processed. 139 cases (51.9%) were missing.

final grade \( (p > .05) \). As a result of this analysis, all three courses were combined for subsequent testing of the hypotheses.

Testing of the Hypotheses

Hypothesis 1

The first hypothesis was tested to determine if there was a significant relationship between level of attendance at SI and final course grades. Attendance was defined as the number of SI sessions a
Table 4

Analysis of Variance: Final Course Grade by Attendance by Course

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACT</td>
<td>36.046</td>
<td>1</td>
<td>36.046</td>
<td>51.776</td>
<td>.000</td>
</tr>
<tr>
<td>Main effects</td>
<td>13.331</td>
<td>5</td>
<td>2.666</td>
<td>3.830</td>
<td>.003</td>
</tr>
<tr>
<td>ATTD</td>
<td>12.110</td>
<td>3</td>
<td>4.037</td>
<td>5.798</td>
<td>.001</td>
</tr>
<tr>
<td>COURSEID</td>
<td>1.760</td>
<td>2</td>
<td>0.880</td>
<td>1.264</td>
<td>.285</td>
</tr>
<tr>
<td>Explained</td>
<td>49.376</td>
<td>6</td>
<td>8.229</td>
<td>11.821</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>112.086</td>
<td>161</td>
<td>0.696</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>161.463</td>
<td>167</td>
<td>0.967</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. 268 cases were processed. 100 cases (37.3%) were missing.

null hypothesis stated that the Pearson product-moment correlation between attendance at SI and final course grade was equal to zero.
Statistical Procedure

A Pearson product-moment correlation was computed to test the null hypothesis. A significant relationship was found between the two variables ($r = .3142, p = .002$).

Findings

The probability that a correlation coefficient of .3142 or greater would have occurred if the correlation between level of attendance at SI and final course grade was zero is .002. Since this is less than the established alpha level of .05, the null hypothesis was rejected. The evidence supports the conclusion that there is a significant and positive relationship between level of attendance at SI and final course grade.

Hypothesis 2

The second hypothesis was tested to determine if students who attended SI earned significantly higher final course grades than students who did not attend SI. Attendance was defined dichotomously: Students who attended one or more sessions were included in the SI group; students who attended no sessions were included in the non-SI group (see Table 5).
Table 5

Final Course Grades of Subjects

<table>
<thead>
<tr>
<th>Grade</th>
<th>Subjects (n = 268)</th>
<th>SI group (n = 92)</th>
<th>Non-SI group (n = 176)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>A (4.0)</td>
<td>30</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>BA (3.5)</td>
<td>16</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>B (3.0)</td>
<td>28</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>CB (2.5)</td>
<td>48</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>C (2.0)</td>
<td>55</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>DC (1.5)</td>
<td>12</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>D (1.0)</td>
<td>17</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>E,X (0.0)</td>
<td>10</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>W</td>
<td>52</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>X grade</td>
<td>2.43</td>
<td>2.64</td>
<td>2.26</td>
</tr>
</tbody>
</table>

Note. Percentages rounded to nearest whole number. Mean grade adjusted for ACT. Official withdrawals (W) are not calculated in the GPA.

Null Hypothesis

The null hypothesis stated that the mean final course grade of students who attended SI was equal to the mean final course grade of students who did not attend SI.
Statistical Procedure

An analysis of variance with ACT as the covariate was used to test the null hypothesis.

Findings

The evidence supported rejection of the null hypothesis. The calculated F probability (see Table 6) indicated that the likelihood of obtaining means as different as those of the SI group and non-SI group was .006, less than the determined alpha level of .05. The means adjusted for ACT were 2.64 for the SI group and 2.26 for the non-SI group. The evidence supports the conclusion that there is a difference in the final course grade of students who attend SI and students who do not attend SI.

Hypothesis 3

The last hypotheses was tested to determine if there was a significant difference in the grade distribution between students who attended SI and students who did not attend SI. Since SI courses were selected on the basis of the percentage of students who earned below a 2.0 (C) or withdrew from the course, this criterion was used to categorize grades (see Table 7).
### Table 6
Analysis of Variance: Final Course Grade by Attendance/Nonattendance

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Sig of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACT</td>
<td>36.046</td>
<td>1</td>
<td>36.046</td>
<td>49.642</td>
<td>.000</td>
</tr>
<tr>
<td>Main effects</td>
<td>5.607</td>
<td>1</td>
<td>5.607</td>
<td>7.722</td>
<td>.006</td>
</tr>
<tr>
<td>ATTEND</td>
<td>5.607</td>
<td>1</td>
<td>5.607</td>
<td>7.722</td>
<td>.006</td>
</tr>
<tr>
<td>Explained</td>
<td>41.653</td>
<td>2</td>
<td>20.826</td>
<td>28.682</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>119.810</td>
<td>165</td>
<td>0.726</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>161.463</td>
<td>167</td>
<td>0.967</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. 268 cases were processed. 100 cases (37.3%) were missing.

### Table 7
Final Course Grade Distribution

<table>
<thead>
<tr>
<th>Final grade</th>
<th>Population (n = 268)</th>
<th>(n = 92)</th>
<th>Non-SI group (n = 176)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>C or above</td>
<td>177</td>
<td>66</td>
<td>69</td>
</tr>
<tr>
<td>Below C or withdrew</td>
<td>91</td>
<td>34</td>
<td>23</td>
</tr>
</tbody>
</table>

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Null Hypothesis

The null hypothesis stated that the proportion of SI students who earned a 2.0 or above in the course equaled the proportion of non-SI students who earned a 2.0 or above in the course and that the proportion of SI students who earned below a 2.0 or withdrew from the course equaled the proportion of students who earned below a 2.0 or withdrew from the course.

Statistical Procedure

A chi square was computed to test the independence of these two groups. The analysis was first completed using a 2 x 2 design, with attendance defined dichotomously and grades categorized as 2.0 or above and below 2.0 or withdrawals. A significant difference in proportions was found between the two groups ($\chi^2 = 5.00977, df = 1, p = .025$). See Table 8.

An additional analysis was completed for refinement purposes. A 2 x 3 design was constructed with attendance defined dichotomously and grades categorized as withdrawals, below 2.0, and 2.0 or above. A significant difference in proportions was again found ($\chi^2 = 8.42596, df = 2, p = .01480$). See Table 9.

Findings

The probability that the proportion of students in the SI group and non-SI group who earned grades in each category (2.0 or above, below 2.0 or W) would occur when the proportions were equal was less
Table 8

2 x 2 Chi-Square Results for Attendance by Grade

<table>
<thead>
<tr>
<th></th>
<th>Non-SI</th>
<th>SI</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 2.0 or W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>68</td>
<td>23</td>
<td>91</td>
</tr>
<tr>
<td>Predicted</td>
<td>59.8</td>
<td>31.2</td>
<td>34.0%</td>
</tr>
<tr>
<td>Residual</td>
<td>8.2</td>
<td>-8.2</td>
<td></td>
</tr>
<tr>
<td>2.0 or above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>108</td>
<td>69</td>
<td>177</td>
</tr>
<tr>
<td>Predicted</td>
<td>116.2</td>
<td>60.8</td>
<td>66.0%</td>
</tr>
<tr>
<td>Residual</td>
<td>-8.2</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td>176</td>
<td>92</td>
<td>268</td>
</tr>
<tr>
<td>Total</td>
<td>65.7%</td>
<td>34.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Note. Chi square = 5.00977, df = 1, p = .02520.

than .05. The evidence supports rejection of the null hypothesis and acceptance of the research hypothesis: There is a significant difference in the grade distribution of the SI group and the non-SI group.

Statistically significant differences were found in both analyses; however, in the second analysis, the differences were in the proportion of students who withdrew from the course and the proportion of students who earned a 2.0 or above. No practical differences were noted in the proportion of students who earned grades in the 1.99-0.00 range.
Table 9
2 x 3 Chi-Square Results for Attendance by Grade

<table>
<thead>
<tr>
<th></th>
<th>Non-SI</th>
<th>SI</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>W Actual</td>
<td>43</td>
<td>9</td>
<td>52</td>
</tr>
<tr>
<td>Predicted</td>
<td>34.1</td>
<td>17.9</td>
<td>19.4%</td>
</tr>
<tr>
<td>Residual</td>
<td>8.9</td>
<td>-8.9</td>
<td></td>
</tr>
<tr>
<td>Below 2.0 Actual</td>
<td>25</td>
<td>14</td>
<td>39</td>
</tr>
<tr>
<td>Predicted</td>
<td>25.6</td>
<td>13.4</td>
<td>14.6%</td>
</tr>
<tr>
<td>Residual</td>
<td>-0.6</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>2.0 or above</td>
<td>108</td>
<td>69</td>
<td>177</td>
</tr>
<tr>
<td>Predicted</td>
<td>116.2</td>
<td>60.8</td>
<td>66.0%</td>
</tr>
<tr>
<td>Residual</td>
<td>-8.2</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td>176</td>
<td>92</td>
<td>268</td>
</tr>
<tr>
<td>Total</td>
<td>65.7%</td>
<td>34.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Note. Chi square = 8.42596, df = 2, p = .01480.

Post Hoc Analysis

Although not tested as part of this research study, additional information was noted regarding distribution of final course grades. Attendance was divided into four categories. See Table 10.
Table 10
Final Course Grades Grouped by Attendance Categories

<table>
<thead>
<tr>
<th>SI sessions</th>
<th>n</th>
<th>Adjusted mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>176</td>
<td>2.27</td>
<td>.083</td>
</tr>
<tr>
<td>1-2</td>
<td>57</td>
<td>2.45</td>
<td>.126</td>
</tr>
<tr>
<td>3-6</td>
<td>17</td>
<td>3.07</td>
<td>.260</td>
</tr>
<tr>
<td>7 +</td>
<td>18</td>
<td>3.10</td>
<td>.242</td>
</tr>
</tbody>
</table>

The grades of students who attended only 1-2 SI sessions were comparable to students in the non-SI group. However, students who attended 3 or more sessions earned a full letter grade higher (B vs. C) than the non-SI group.

When contrasting all pair-wise comparisons (using ACT as the covariate), it was determined that there was a significant difference in the final course grades of students who attended 3 or more SI sessions and students who attended fewer than 3 sessions (p < .05). No significant difference was found between the final course grades of students who attended 0 sessions as compared to students who attended 1-2 sessions or between students who attended 3-6 sessions as compared to students who attended 7 or more sessions.

A difference was also noted in the percentage of students who earned a B or higher. Sixty-one percent of the students who attended 7 or more sessions earned a 3.0 or higher as compared to only 25% of the students who did not attend SI. See Table 11.
### Table 11

Grade Distribution by Attendance Category

<table>
<thead>
<tr>
<th>SI sessions</th>
<th>Grade</th>
<th>4.0</th>
<th>3.5</th>
<th>3.0</th>
<th>2.5</th>
<th>2.0</th>
<th>1.5</th>
<th>1.0</th>
<th>0.0</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>11%</td>
<td>5%</td>
<td>9%</td>
<td>16%</td>
<td>21%</td>
<td>4%</td>
<td>5%</td>
<td>5%</td>
<td>24%</td>
</tr>
<tr>
<td>1-2</td>
<td></td>
<td>14%</td>
<td>0%</td>
<td>7%</td>
<td>23%</td>
<td>23%</td>
<td>9%</td>
<td>11%</td>
<td>2%</td>
<td>12%</td>
</tr>
<tr>
<td>3-6</td>
<td></td>
<td>6%</td>
<td>18%</td>
<td>24%</td>
<td>29%</td>
<td>12%</td>
<td>0%</td>
<td>12%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>7+</td>
<td></td>
<td>11%</td>
<td>28%</td>
<td>22%</td>
<td>11%</td>
<td>17%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>11%</td>
</tr>
</tbody>
</table>

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CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

Summary

Supplemental Instruction (SI) is an academic support program designed to help college and university students succeed in difficult courses. The SI model combines elements of peer tutoring and study skills instruction, but differs from both in the purposeful integration of learning strategy with course content.

Learning center staff at the University of Missouri-Kansas City (UMKC) developed the SI model in the mid 1970s. The original goal of the program was to reduce the attrition rate among minority students enrolled in preprofessional science courses. Supplemental Instruction is based on the assumption that students often perceive their need for academic support as content-related, when in fact they lack the basic learning and study skills needed to succeed. Earlier research reported on peer tutoring and study skills programs supported this assumption.

The initial research reported on the SI model from UMKC documented the relationship between attendance at SI and final course grade. Students who attended SI earned higher final course grades and a greater percentage of Bs and Cs than nonparticipants. Subsequent research completed at UMKC supported these findings.
Reports on the program from other campuses are limited. Those studies that have been reported each found that students who attended SI earned higher final course grades than students who did not attend; however, each program differed from the model in the use of faculty or staff, rather than undergraduate students, to lead SI sessions.

Purpose

The purpose of this study was to determine if there was a significant relationship between attendance at SI and final course grades in a program where only undergraduate students led SI sessions. This was the first study to follow the stated standards for selecting SI leaders. Two hundred sixty-eight students enrolled in three 100-level science courses participated in this study; 92 students (34%) attended SI during the semester. Attendance ranged from 1-30 sessions and averaged 4.5 hours per participant.

Research Hypotheses

Three research hypotheses were investigated:

1. There is a significant relationship between level of attendance at SI and final course grades.

2. Students who attend SI earn significantly higher final course grades than students who do not attend SI.

3. There is a significant difference in the grade distribution of students who attend SI and students who do not attend SI.
Preliminary testing was conducted to determine if there was a significant relationship between final course grade and five variables: composite ACT score, sex, classification, race, and course. A significant relationship was found between composite ACT score and final course grade; consequently, ACT was used as a covariate in subsequent analyses. No significant relationship was found between the remaining four variables and final course grade. However, students who enroll in these difficult, entry-level courses may be different from students who choose not to enroll in these courses. Readers should be aware that the lack of relationship between these variables is limited to this study and should not be generalized to other populations.

Each research hypothesis was stated in the null form and tested at the .05 level of significance. The first hypothesis was tested using a Pearson product-moment correlation. The second hypothesis was tested using an analysis of variance with ACT as the covariate. The third hypothesis was tested using a chi-square procedure.

Findings

Three major findings were reported in this study:

1. There was a positive, significant relationship between level of attendance at SI and final course grade ($p = .002$). Students who attended SI more frequently earned higher final course grades. However, this relationship should not be interpreted to imply causation. Factors other than attendance at SI may have been related to final course grade.
2. There was a significant difference in the final course grades of students who attended SI and students who did not attend SI \((p = .006)\). The final course grades (adjusted for composite ACT score) of the SI group was a half letter grade higher than the final course grade of the non-SI group (CB vs. C).

3. There was a significant difference in the grade distribution of students who attended SI and students who did not attend SI \((p = .025)\). Students who attended SI were more likely to earn a final course grade above a C (2.0) than students who did not attend SI. Subsequent testing of this hypothesis refined the analysis by separating withdrawals from grades below a C. Statistically significant differences were again found in this 2 x 3 chi-square test \((p = .0148)\). However, an analysis of the actual and predicted proportions found that the differences were among students who withdrew from the course or earned a 2.0 or above. No practical differences were noted in the proportions of students who earned in the 1.99-0.00 range.

Additional information regarding grade distribution was noted. The average grade of students who attended 1-2 SI sessions was comparable to the average grade of students in the non-SI group. However, students who attended 3-6 sessions earned a half letter grade higher (CB vs. C) than the non-SI group; and students who attended 7 or more sessions earned a full letter grade higher (B vs. C). Significant differences were found between the grades of students who attended 3 or more SI sessions and students who attended fewer than 3 sessions \((p < .05)\). Frequent attendance seems to be an important variable and warrants further study.
Each of these findings needs to be interpreted with caution. Many factors other than attendance at SI may be related to final course grade. This study tested the relationship between five additional variables, composite ACT score, sex, classification, race, and course, and found only composite ACT to be significantly related to final course grade. However, motivation, not accounted for in this study, may be an important variable in determining both final course grade and attendance at SI.

In addition, this study had most if not all of the characteristics of a case study. Consequently, these findings were not intended to be generalized to other populations.

Conclusions

The findings from this study corroborate earlier research reported on the SI model: There is a positive and significant relationship between attendance at SI and final course grade. This was the first study to follow the stated standards for selecting SI leaders. The findings from this study, where only undergraduate students led SI sessions, add a new dimension to the research previously reported and provide important staffing information for other colleges and universities.

Recommendations for Further Study

Additional research is needed to identify those elements of the SI model that contribute to student achievement. The model consists of numerous variables, any one of which could be instrumental in the
success of the program.

Course selection may be an important factor. This study focused only on science courses. Research completed at UMKC included only courses in the College of Arts and Science; research from other campuses included courses in Spanish, psychology, and American history. Missing from all the reports is an analysis of the program in mathematics and engineering courses, high-risk courses on many campuses.

SI leaders are a key component of the program. Although mastery of course content seems an essential prerequisite, other variables might be related to the success of SI leaders. Case studies of SI leaders in various disciplines might provide useful information which could be used in hiring.

The integration of course content with effective study strategies is a major characteristic which distinguishes SI from both peer tutoring and study skills instruction. An experimental design which randomly assigned students in high-risk courses to one of these three support programs (SI, peer tutoring, or study skills) would provide additional information on the effectiveness of each approach.

Factors related to attendance have not been identified in previous reports. In this study 34% of the subjects attended SI. On other campuses attendance ranged from 21% to 46%. Research on effective methods of increasing participation is also needed.
Appendix A

Approval From Human Subjects
Institutional Review Board
TO:  Sally Pryor
FROM: Ellen Page-Robin, Chair
RE: Research Protocol
DATE: August 31, 1988

This letter will serve as confirmation that your research protocol, "Supplemental Instruction: A Program of Academic Support for Students in High Risk Courses," is now complete and has been signed off by the HSIRB.

If you have any further questions, please contact me at 387-2647.
Appendix B

Student Consent Form
STUDENT CONSENT FORM

I AGREE TO PARTICIPATE IN THE RESEARCH STUDY ON SUPPLEMENTAL INSTRUCTION AND GIVE DR. _______ PERMISSION TO RELEASE MY GRADES IN THIS COURSE TO THE RESEARCHER.

I UNDERSTAND THAT I MAY WITHDRAW FROM THIS STUDY AT ANY TIME BY GIVING WRITTEN NOTICE TO THE RESEARCHER. MY REFUSAL TO SIGN THIS CONSENT FORM OR TO PARTICIPATE IN THE STUDY WILL NOT AFFECT MY GRADE OR MY ELIGIBILITY TO ATTEND SI SESSIONS.

I ALSO UNDERSTAND THAT GRADES AND PARTICIPATION INFORMATION WILL BE REPORTED IN TERMS OF GROUPS; INDIVIDUAL STUDENTS WILL NOT BE IDENTIFIED.

----------------------------------  ----------------------------------
NAME                                   DATE
Appendix C

SI Survey
Supplemental Instruction
ACADEMIC SKILLS CENTER

NAME _____________________________________________

COURSE ____________________________________________

DIRECTIONS: Please circle your response.

1. On a scale of 1 to 5, with 1 being NOT interested at all and 5 being VERY interested, please indicate your interest in attending SI sessions for this course.

   1  2  3  4  5

2. What grade do you expect to earn in this course?

   A  B  C  D  E

3. How many credit hours are you taking this semester.

   A. Less than 12
   B. 12 - 15
   C. More than 15

4. Why are you taking this course?

   A. Required for major/minor
   B. To fulfill a General Education requirement
   C. Interested in the course as an elective

DIRECTIONS: Put an X on the schedule below on the hours that you ARE AVAILABLE AND MOST LIKELY TO ATTEND SI.

<table>
<thead>
<tr>
<th>Time</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thur</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 - 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 - 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Appendix D

Registration Form
ACADEMIC SKILLS CENTER AND SPECIAL SERVICES PROGRAM
REGISTRATION

PLEASE USE PEN, PRINT, AND ANSWER EVERY QUESTION.

NAME
last first m.i. SS#

LOCAL ADDRESS
street or residence hall city state zip

HOME COUNTRY
SEX M F GRADE LEVEL Fr Soph Jr Sr Grad

BIRTH DATE
/ /
mo day year

RACIAL/ETHNIC GROUP
Black White Hispanic Native American Other MAJOR

PLEASE CHECK YES OR NO.
Yes No
Are you a U.S. citizen?
Are you in the Alpha Program? Were you in the Alpha Program?
Are you in the MLK Program? Were you in the MLK Program?
Do you have a physical handicap? If yes, please describe.
Have you ever been diagnosed as having a learning disability?
Has either your mother or father graduated from a four-year college?

WRITING LAB
department course number professor
TIMES AVAILABLE TO ATTEND M T W R F

ARE YOU A FRESHMAN REQUESTING 2 HOURS PER WEEK? Yes No

WORKSHOPS (You may register for more than one.)
STUDY SKILLS VOCABULARY EDITING BRUSHUPS
SPELLING CRITICAL READING INTERNATIONAL STUDENT COMMUNICATION
MATH REVIEW (FALL SEMESTER)

SSP TUTORING (for eligible students only)
department course number professor
TIMES AVAILABLE TO ATTEND M T W R F

FOR OFFICE USE ONLY
TUTOR ASSIGNED WORKSHOPS ASSIGNED
SSP A B C D DATE ENTERED ON COMPUTER INITIALS

Revised May 31, 1988

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BIBLIOGRAPHY


