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ABSTRACT

The Supplemental Instruction (SI) model of student academic assistance helps students master classes that have a history of a high degree of difficulty as they develop and integrate learning and study strategies. This paper reviews research on SI, developed at the University of Missouri-Kansas City, which has been selected as an Exemplary Educational Program by the U.S. Department of Education. The SI program is used by faculty who teach courses that have been identified as high risk (30% failure rate or higher). An SI leader provides three to five SI lessons out of class each week. The paper reviews the effectiveness of the SI program, discusses its specific features, and reviews program costs. It also reports on the results of six studies of SI at the University of Missouri and other locations. Results of these studies indicate that the program has positive effects on course grades, re-enrollment rates, and graduate rates across racial and ethnic groups. (Contains 32 references.) (SLD)

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Supplemental Instruction (SI)

Review of Research Concerning the Effectiveness of SI from The University of Missouri-Kansas City and Other Institutions from Across the United States

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Goals, Purpose and Audience for Supplemental Instruction (SI)

The Supplemental Instruction (SI) model of student academic assistance helps students in historically difficult classes master course content while they develop and integrate learning and study strategies. Goals of SI include:

- Improve student grades in targeted historically difficult courses
- Reduce the attrition rate within those courses
- Increase the eventual graduation rates of students.

Some educational researchers (Dimon, 1988; Keimig, 1983) have concluded that it is difficult to teach transferable study skills in isolation from content material, and SI offers an alternative. Experts in higher education have recognized that there is a need for increased emphasis on student retention, particularly for first-generation and economically-disadvantaged students. American society cannot afford the economic and social cost of college drop outs who are not able to fulfill their potential.

All students in a targeted course are urged to attend SI sessions, and students with varying ability levels and ethnicities participate. There is no remedial stigma attached to SI since **historically difficult courses** rather than **high risk students** are targeted.

Method of SI Operation

SI is attached to specific historically difficult courses. There are four key persons involved with SI. The first is the **SI supervisor**, a trained professional on the SI staff. The SI supervisor is responsible for identifying the targeted courses, gaining faculty support, selecting and training SI leaders, and monitoring and evaluating the program. Once the historically difficult courses have been identified, the SI supervisor contacts the faculty member concerning SI for their course. The second key person for SI is the **faculty member** who teaches one of the identified historically difficult courses. SI is only offered in courses in which the faculty member invites and supports SI. Faculty members screen SI leaders for content competency and approve selections. The third key person is the **SI leader**. SI leaders are students or learning center staff members who have been deemed course competent, approved by the course instructor and trained in proactive learning and study strategies. SI leaders attend course lectures, take notes, read all assigned materials, and conduct three to five out-of-class SI sessions a week. The SI leader is the "model student," a facilitator who helps students to integrate course content and learning/study strategies. The fourth key member of the SI program are the **participating students**. SI can be implemented in one course each semester, or in many more. The only difference would be an increase of one additional SI leader for each additional course. An increase of SI leaders would require an increase of SI supervisory personnel. Costs for implementing the program could be covered through various means (e.g., staff release time, work study funds, fee waivers).

History of Supplemental Instruction

SI was created by Deanna C. Martin, Ph.D., at the University of Missouri-Kansas City in 1973. After initially offering SI at the health science professional schools, it was extended throughout the institution. After a rigorous review process in 1981, the SI Program became one of the few postsecondary programs to be designated by the U.S. Department of Education as an ***Exemplary Educational Program***. The National Diffusion Network (NDN), the national dissemination agency for the U.S. Department of Education, provided

federal funds for dissemination of SI until the NDN was discontinued by the U.S. government. National and international dissemination continues. As of November 1995 faculty and staff from 614 institutions across the nation had received training to implement their own SI program. SI is active at 115 institutions in 12 countries (Australia, Canada, Denmark, Egypt, Marshall Islands, Malaysia, New Zealand, Puerto Rico, South Africa, Sweden, United Kingdom, and West Indies).

Claims of SI Effectiveness Validated by the U.S. Department of Education

Claim 1. Students participating in SI within the targeted historically difficult courses earn higher mean final course grades than students who do not participate in SI. This is still true when differences are analyzed, despite ethnicity and prior academic achievement.

Claim 2. Despite ethnicity and prior academic achievement, students participating in SI within targeted historically difficult courses succeed at a higher rate (withdraw at a lower rate and receive a lower percentage of D or F final course grades) than those who do not participate in SI.

Claim 3. Students participating in SI persist at the institution (reenrolling and graduating) at higher rates than students who do not participate in SI.

Description of the SI Program

A. Goals of SI

The three closely-related goals of Supplemental Instruction (SI) are

- Improvement of student course grades
- Reduction of attrition rates in historically difficult college courses
- Student persistence toward graduation.

SI accomplishes these purposes by using the process of cooperative/collaborative learning to integrate instruction in learning and reasoning skills with a review of the course content of selected

courses.

B. Purposes and Needs Addressed by SI

Supplemental Instruction (SI) was developed as an academic assistance program in response to a high rate (40 percent) of student attrition. An examination of student records revealed that attrition is highest in the first six weeks of the first year student academic term (Noel et. al., 1985). Furthermore, entry profiles did not necessarily predict students who were at risk of dropping out. Special features of the SI program are:

(1) The emphasis in SI is on **high-risk courses** (those classes with a 30 percent rate of grades of D, F, and Withdrawals) rather than **high-risk students**. In this way, the program avoids the remedial stigma often attached to traditional academic assistance programs. SI is open to all students in the targeted course; therefore, pre-screening of students is unnecessary. The program also provides academic assistance during the critical first six-week period of class. SI is often attached to high-risk courses that serve first and second-year students; however, each institution may develop its own definition of "high-risk courses."

(2) The SI leader is a **facilitator**, not a **mini-professor**. The role of the leader is to provide structure to the study session, not to re-lecture or introduce new material. The SI leader is a "model student" who shows how successful students think about and process the course content. Collaborative learning is an important strategy since it helps students to empower themselves rather than remaining dependent as they might in traditional tutoring. Research suggests those tutoring relationships do not promote transfer of needed academic skills (Dimon, 1988; Martin, et.al, 1991a, 1991b, 1990, 1983, 1982, 1981).

(3) SI focuses on both **process** and **content**. Therefore, learning/study strategies (e.g., note-taking, organization, test preparation) are integrated into the course content during the SI sessions. SI sessions provide immediate practice and reinforcement of these acquired skills. SI collaborative sessions capitalize on the use of the "teachable moment" to apply the learning strategies to the course material.

[page 2]

Nationally, high student attrition among first year college students continues to be a trend (American College Testing Program, 1996). Tinto (1987, p. 1) predicted in 1986 that of the nearly 2.8 million students who entered higher education for the first time, more than 1.8

million will leave without receiving a degree. Tinto, regarded by many as the expert in student retention in post-secondary education, has identified four significant factors in the dropout of students (1989, p. 47). Many students felt socially isolated on campus. Students had difficulty in adjusting to the new environment. Students suffer from incongruence (i.e., they were not able to link the knowledge received from class lectures to what they already understood). The final factor was that students had difficulty in the college environment. The SI program can be part of a broad institutional response to help address these four problems. The SI review sessions provide a safe environment for students to discuss and process the course material. Students in SI become acquainted with each other as they interact. The SI leader facilitates the discussion so that students can make adjustments, discuss what they do not understand and discover strategies for mastering difficult material.

C. Intended Audience for SI

SI targets "historically difficult" courses rather than high-risk students. At many campuses historically difficult courses are typically defined as difficult, entry-level courses in which the unsuccessful enrollment rate (the percent of grades of D, F, and Withdrawals) is more than 30 percent. Examples of these courses at UMKC include: General Chemistry I, Western Civilization I and Foundations of Philosophy. Since a new SI program often places an emphasis on entry-level courses, SI has often served primarily first year and sophomore level students. However, the program has been effectively implemented in courses where students are likely to fail at the graduate and professional school level (e.g., Medicine, Dentistry, Pharmacy, Business, and Law) both at UMKC and other post-secondary institutions. Despite academic discipline or grade level, SI has been effective. This history of success with SI in upper division courses is important because some institutions implement SI to retain first-generation and low-income professional school students. Each institution can adjust the definition of "historically difficult courses" to meet their own institutional objectives and needs. SI is effective with students from a variety of ethnic, economic and academic preparation backgrounds.

The following are departments within the College of Arts and Sciences or professional and graduate schools where SI has been offered at UMKC (Number Inside Brackets Represents Number of Different Courses): Art [1]; Biology [3]; School of Business [3]; Chemistry [6]; School of Dentistry [1]; Economics [2]; Foreign Language [3]; History [6]; English [2]; School of Law [5]; Mathematics [3]; School of

Medicine [3]; School of Pharmacy [2]; Philosophy [1]; Physical Science [1]; Political Science [2]; and Sociology [2]. SI Programs from other institutions report its use in similar areas and use in Engineering, English-as-a-Second Language and other disciplines.

Courses are designated as "historically difficult" if there is a continuous record in preceding semesters that students receive a high percentage of D or F final course grades or withdraw from the course. The purpose of attaching SI is to assure that the course is no longer difficult for a large number of students. It does not, however, lose its "historically difficult" status for services. Once the D, F and withdrawal rate has been reduced, the SI service is continued since nothing has been done to change the course per se. Data suggests that when SI was not provided for the course (e.g., cannot find a suitable SI leader), the D, F and withdrawal rate returns to the original baseline. The only condition under which a decision is made to discontinue SI is when a change of course instructor results in uniformly higher grades and, subsequently, lower levels of student participation in SI. The campus SI supervisor continuously monitors the impact of SI in every course where it is offered through comparative data for students who attend SI and those who do not attend.

Definition of "historically difficult" course relates to a single factor: the percent of students who complete the course successfully. It is irrelevant whether the high rate of poor grades and withdrawals is a function of the course content, the instructional method, the hour the course is offered, or the population to whom it is offered.

[page 3]

The critical factor is that students have academic difficulty. SI reduces that difficulty. There is no claim that SI addresses every need.

It should be noted that there is substantial evidence that attrition follows poor grades. Students tend not to withdraw from courses or drop out of college when grades are acceptably high. In 1990, Noel and Levitz from the National Center for Student Retention published a research study that suggests a strong correlation between grade point averages and persistence in college (Table 1). SI is designed to increase student academic performance that is generally indicated by higher final course grades.

Table 1: Dropouts and Persisters: Separated by College Grade Point Average

(N of Students = 3,874 and N of Institutions = 43)

Grade Point Average Range	Dropouts (N = 1,060 Students)	Persisters (N of Students = 2,814)
GPA Below 2.00	42.1% (N = 336)	15.8% (N = 445)
GPA 2.00 to 2.49	18.9% (N = 200)	24.9% (n = 701)
GPA 2.50 to 2.99	19.6% (N = 208)	26.2% (n = 737)
GPA 3.00 to 4.00	19.1% (N = 206)	33.1% (n = 931)

The goal of the SI program is not to evaluate the curriculum or instructional delivery of the course professor, but to help the enrolled students perform satisfactorily in traditionally difficult courses. Other institutions, however, sometimes have other concerns (e.g., curriculum reform, improved instruction). Some institutions have addressed these issues with the introduction of SI. UMKC can provide information about these efforts upon request. While SI does not meet every student's needs, it is a delivery system that is flexible enough to meet many students' needs.

D. Background, Foundation and Theoretical Framework for SI

Research and writing in intellectual development (Piaget, Dale, Arons, and Perry) and in college student development and retention (Pascarella, Tinto, Astin, Light, Noel, and Levitz) support the empirical framework upon which SI is based. Students "who form study groups report that they both enjoy their work more, and feel they learn more, because of the academic discussions within these groups" (Light, 1990, p. 18). "In every comparison of how much students learn when they work in small groups or when they work alone, small groups show the best outcomes" (Light, 1990, p. 10). Such experiences improve both the cognitive and affective domains of the students (Sandberg, 1990). Astin (1987) cited collaborative learning as an important tool for teaching students how to work together before they enter the work world. "The student's peer group is the single most potent source of influence on growth and development during the undergraduate years" (Astin, 1993, p. 398).

Keimig (1983) developed a "Hierarchy of Learning Improvement Programs." Lowest ranked were remedial courses that taught skills in

isolation. The second from the bottom was tutoring since it generally was used after academic difficulty or failure had been experienced. Using Keimig's model, programs similar to SI were ranked near the top of the effectiveness scale since, "students' learning needs are presented as being necessary because of the nature of the objectives and content of the course rather than because of student's deficiencies. Therefore, all students have access to supplementary . . . instructional experiences, which benefit nonremedial students as well (Keimig, 1983, p. 23)."

[page 4]

Since there are no students who are pretested into the SI program, and since SI is open to all students in the targeted class, students are not subjected to a remedial stigma. "One way of integrating all students is to make sure our learning communities are open communities" (Tinto, 1990, p. 22). Despite the student's previous academic success, SI sessions are designed to benefit everyone. "Successful institutions know that ultimately student retention is a by-product of student success and satisfaction" (Noel, Levitz, & Saluri, 1985, p. xiii). Rigorous evaluation suggests that SI helps to provide that success and satisfaction. Effective assistance is particularly important during the first year of college when students need "front-end" academic support (Upcraft, Gardner, & Associates, 1989). The SI model uses collaborative learning (Johnson, et al., 1991; Tomlinson, 1989; Whitman, 1988). SI leaders are trained in proactive learning strategies. Based upon a recently completed annotated bibliography of more than 800 citations on collaborative learning (Tumey, 1993), the SI model is well represented in the professional literature.

E. Features: How the SI Program Works

(1) Scope: Academic assistance programs exist on almost all college campuses today. These programs may include special counseling and academic advising, one-on-one tutoring, remedial or developmental courses and study skills courses. The central purpose of these programs is to support and retain students. Sometimes, SI supplements these offerings; in others, SI replaces one or more components of an existing academic assistance program. In either case, the addition of SI serves to enhance the total campus retention effort. Besides the previous definition of a historically difficult course (30 percent of students receive a D or F final course grade or withdraw), at UMKC these courses would include one or more of the following characteristics: large in size; mostly lecture with little opportunity for question/answer; or a "gatekeeper" course that must be passed before the student can

enter an academic degree program.

(2) Curriculum and instructional approach: SI sessions are structured to maximize active student involvement with the course material. The SI leader neither relectures nor introduces new material. Instead, the SI leader guides students in using their own class notes and reading materials to help students clarify course concepts. Although the SI leader provides structure and guidance, the responsibility for processing course material remains with the students.

Although faculty members who teach courses targeted for SI are very supportive and involved in the program, they do not receive information regarding the names of their students who participated. While the faculty member is welcome to observe occasionally the SI session, they are not encouraged to make it a regular practice. The SI supervisor must be sensitive to the possibility that some professors may be unintentionally biased with scoring examinations and awarding final course grades based upon student participation in SI.

It is important to ensure that SI not only avoids being viewed as remedial, but also avoids being labeled as compensatory. The incentive for students to participate in SI is increased academic performance. At UMKC, the staff feels it is important that students not receive extra credit for attending SI. Not all students can attend SI due to conflicting class or work schedules and family duties. Nor can all afford the additional tuition expense.

(3) Learner activities: At least three or more hours of SI are available each week per course. During the SI session, the SI leader models application of study strategies such as note taking, graphic organization, questioning techniques, vocabulary acquisition, and test prediction and preparation. Students learn to trust each other to verbalize what they do understand and clarify what they don't understand. At the beginning of the semester, the SI leader provides the structure for the study session. However, as the semester progresses, the students assume responsibility for the structure by creating informal quizzes, visual models, note cards or time lines, brainstorming, designing paired problem solving activities or predicting test questions. This is a powerful use of collaborative learning strategies.

[page 5]

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(4) Learning materials: Students come to the SI session with their course notes, textbooks, and course handouts. The SI leader may occasionally provide a work sheet as part of the planned structure for

the session. The SI group itself, however, becomes the primary learning resource as students clarify and add to each other's knowledge base through discussion and problem solving. During training, adopters receive a SI Supervisor's Handbook. This handbook helps the supervisor in all phases of implementing the SI program. The SI supervisor receives a training notebook to give to SI leaders. Additional resources include monographs related to SI, video tapes related to SI training and management, various survey forms, and supplemental materials.

(5) Staff activities and staffing patterns: The SI program is administered by a professional staff member (e.g., a faculty member, learning skill staff). SI supervisor duties include: selecting courses targeted for SI; gaining faculty approval and support; identifying SI leaders; training SI leaders; evaluating the performance of the SI leader; collecting data on the SI program; and analyzing and reporting the results of the program. SI leaders are usually students who have previously taken and performed well in the targeted class. Sometimes learning center staff members, other students or community members conduct SI. The faculty member, however, must approve the leader as content competent. The SI supervisor assesses the SI leader's communication skills, time restrictions and attitude. Once selected, the SI leader must attend a twelve hour training course; attend all sessions of the targeted class and take notes; complete all assigned readings for the targeted course; schedule and conduct at three or more SI sessions a week during the semester; provide a plan for the SI session using the strategies learned in training; and attend regular meetings with the SI supervisor. Successful SI sessions occur when the SI leader is able to facilitate the group so that students are the ones who generate the answers to questions raised during the sessions.

(6) Staff Development Activities: SI supervisors attend a three and one-half day training workshop that cover the areas of implementation and management, training, supervision, evaluation, and study strategies. Four workshops are hosted at UMKC each year. Upon request, additional workshops are conducted in the field throughout the year by the UMKC staff and its Certified Trainers. Follow-up technical assistance is provided by telephone or occasional requested site visit. The UMKC staff follow up all adopters with telephone calls and a newsletter. Continued professional development is available through professional development seminars hosted by UMKC and through special interest groups dedicated to SI that is offered at several national educational conferences and at UMKC each year. SI leaders begin their development with a twelve hour training workshop held by the SI supervisor before the beginning of each semester. Continued training is

conducted at regular meetings scheduled by the SI supervisor. Informal training occurs because of the supervisor's observation of the SI leader conducting a session. Feedback and specific suggestions for improvement are given to the SI leader then. This observation by the SI supervisor is more frequent at the beginning of the semester.

(7) Management Activities: Data are collected from all targeted courses and form the basis of the end of the semester report. Adopting schools are encouraged to send these reports to UMKC regularly. If a report form suggests unsuccessful implementation, technical assistance from UMKC is provided via the telephone.

For the first two weeks of the semester, SI leaders are observed by their SI supervisor during SI sessions. After that, the SI supervisor will observe a SI session approximately every two weeks throughout the rest of the semester. The SI supervisor holds SI leader staff meetings every two to three weeks to receive informal feedback, discuss problematic areas and collect roll sheets and any handouts that have been generated by leaders for their SI sessions. Other campus programs across the nation report that they meet with their SI leaders once a week, and others meet less frequently.

At the end of Fall, 1991, the "student assistant SI supervisor" was made an official part of the SI model. In the past, UMKC has had only professional staff members serving as SI supervisors. Due to the expansion of

[page 6]

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the number and types of courses covered by SI at UMKC, the decision was made to hire a student who had been a SI leader for several semesters to serve in a supervisory role. This replaced the need to hire an additional professional staff member. This practice of hiring students to help the SI supervisor was originated by the SI Program supervisor at the University of Louisville when the SI program grew beyond the supervisory time available from the professional staff. UMKC decided to test this approach at UMKC and hired the first student assistant SI supervisor during Spring, 1991. This has been very successful. The critical qualities needed in the student assistant is a successful record as a SI leader themselves and their maturity to objectively observe, supervise and manage other SI leaders. When UMKC receives telephone calls from SI supervisors asking about how to remedy the problem of supervising an expanding program, the student assistant SI supervisor is suggested. This is another mechanism for keeping the program cost effective. Also, students seem to like the

opportunity to move up to a supervisory position after serving for several semesters as SI leaders. This builds a career ladder within the SI Program that may attract and retain some leaders.

F. Significance of SI Program Design as Compared to Similar Programs

There are several key elements of SI that differentiate it from group tutoring and other forms of academic support: the SI program is attached to specific courses that are historically difficult for students; participation in the SI program is voluntary; the SI leader attends all targeted course sessions; the SI leader is trained in specific teaching/learning theory and techniques before the beginning of the term; the SI program is supervised by a trained professional staff member; the program is offered only in classes in which the faculty member invites and supports SI; the SI leader facilitates and encourages the group to process the material rather than acting as an authority figure who lectures to participants; and the program is evaluated rigorously.

A major difference between SI and other forms of collaborative learning is the role of the SI leader. Rather than forming study cluster groups and then releasing them in an unsupervised environment, the SI leader is present to keep the group on task with the content material and to model appropriate learning strategies that the other students can adopt and use in the present course and in other ones in future academic terms (Dimon, 1988; Johnson, et.al, 1991).

Potential for Replication of the SI Program

A. Settings and Participants (Development and Evaluation Sites)

Over 300 institutions currently use SI. Table 2 summarizes the 614 initial adoptions from U.S. institutions that either planned or implemented the SI program. An additional 115 institutions abroad have received training as well.

Table 2: SI Adoption Sites by Regions in the United States: January 1982 to September 1995

Regions	82	83	84	85*	86	87	88	89	90	91	92	93	94	95	Total
East				19	15	14	35	18	7	18	24	14	5	14	**183**
Midwest	1	2	2	26	23	18	10	30	21	20	10	19	8	18	**208**
Pacific			1	7	2	12	1	5	16	5	7	8	3	2	**69**
South			2	5	5	11	8	1	4	3	12	9	13	15	**88**

West	2	1		12	4	3	3	4	8	4	4	10	5	6	**66**
Total	**3**	**3**	**5**	**69**	**49**	**58**	**57**	**58**	**56**	**50**	**59**	**60**	**34**	**55**	**614**

East=CD, DC, DE, MA, MD, ME, MI, JN, NY, OH, PA, RI, VT, WV; Midwest=IA, IL, IN, KS, MI, MO, MN, NE, MD, OK, SD, WI; Pacific=AK, CA, ID, NV, OR, WA; South=AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA; West=AZ, CO, MN, MT, NM, TX, UT, WY
* In 1983 UMKC began receiving funds from the USDOE National Diffusion Network for national dissemination activities.

[page 7]

More than 1,100 individuals have been trained as SI supervisors since 1982. This does not include the number of student SI leaders that have been trained each semester on the campuses using the SI program. The average number of SI targeted classes on each campus is 15. The number of students impacted by the SI program nationally each semester is approximately 300,000. Individual programs are assessed through the SI reporting method. Nearly 100 programs each year submit reports concerning the implementation of SI at their home campuses. In addition, each year UMKC conducts a telephone survey to assess the status of the SI program at each adopting site. The results of this survey show that adopting institutions continue to maintain and build their SI programs.

B. Resources Available from UMKC to Help Institutions Implement SI

UMKC is well equipped to respond to requests for SI awareness materials and training. Besides printed materials, the UMKC staff and Certified Trainers provide video tapes for awareness and training purposes. Twelve Certified Trainers are located throughout the U.S. They have completed the SI supervisor training, implemented successful programs on their own campuses and completed additional training to become Certified Trainers. The Certified Trainers and UMKC staff conducted 34 SI awareness presentations and were hosts to 14 SI supervisor training workshops during the 1994-95 academic year. In addition, the staff from UMKC and the Certified Trainers have been active in publishing articles about the SI program. Although UMKC serves as the main demonstration site, all Certified Trainers and most active SI supervisors host interested visitors at their campuses. UMKC staff has provided materials to professionals for use in completing doctoral dissertations concerning SI (Kenney, 1989; McGinty, 1989; Pryor, 1989). The SI supervisor's training handbook has been updated and expanded to 150 pages in length. UMKC has eight training or awareness videos available for dissemination.

Evaluation of these products, presentations, and training workshops by users is consistently in the outstanding range on a Likert scale. New research findings from the UMKC site and from SI supervisors in the field are disseminated throughout the SI network via a quarterly newsletter.

C. Requirements for Successful Implementation of SI

To estimate the cost of implementing SI at an institution, three factors needed to be considered. First, will the institution need to employ new personnel to implement the program, or can it use existing personnel? Second, will the SI supervisor need assistance from other personnel? Third, what types of support will be forthcoming from the adopting institution in terms of release time and use of facilities? Despite the number of SI's to be implemented, one person from the institution needs to go through the three and one-half day training workshop with the UMKC staff or one of its Certified Trainers. The SI supervisor needs to have release time for each SI that they will supervise. The time commitment required of the SI supervisor will vary over the course of the semester. During the first two weeks of the academic term, the SI supervisor attends all lectures in the targeted course and all SI sessions. After this first intensive period, the SI supervisor's time commitment diminishes.

When a new SI program is being implemented on a campus, it requires more time than when the program is established. When starting up the program, the SI supervisor will need to work more intensively with faculty members, administrators and other staff members. UMKC finds that during the first two weeks of the semester it takes about six hours per week to supervise each class where SI is offered. During this initial intense period in the semester, a person could not be expected to supervise more than seven classes where SI was being offered. This is the reason UMKC recommends that institutions only begin with a few sections of SI in order for the SI supervisor to become comfortable with implementing the program. There is an economy of scale as the program grows larger; therefore, it is not necessary for the administrative support to grow at the same rate. Also, the introduction of the "student assistant SI supervisor" has also provided a cost-effective strategy to manage the time and expense with administering a SI program.

[page 8]

Data gathered through reviewing individual program reports and a telephone survey suggest that SI leader salaries vary greatly by

institution. If a SI leader is paid hourly, their preparation time and their time in the SI session are documented. A small private community college in New York is currently offering two SI's a semester and pays a minimum wage, $4.25 an hour. A medium sized college in New Jersey pays $7.25 an hour and manages approximately ten SI's a semester. A large public university in Utah offers $4.50 to $6.00 an hour and conducts 200 SI's yearly. It appears that the mean wage for SI leaders is approximately $5.50 per hour. Other institutions prefer to offer a semester stipend. UMKC's SI leaders are paid $850 to $950 each semester (higher pay for returning SI leaders). A medium sized college in Illinois classified their SI leaders as equivalent in status to laboratory assistants on their campus and pays them $2,000 per semester. SI leaders are not always rewarded monetarily. A medium size university in Kansas rewards their SI leaders by giving them academic credit from their school of education.

D. Costs for Implementation and Operation of the SI Program

During the 1980-81 academic year, UMKC provided SI services to 566 students in 10 courses at a cost of $34,500; an average cost of $60.95 per student. The total program costs increased in FY 1995-96 since SI was offered in 41 courses, additional supervisory personnel were required and wages had increased since 1980. However, the average cost per student had decreased to $46.89 since more students were served (1,454) and increased reliance was made of student assistant SI supervisors. Personnel costs include salaries for a full-time SI supervisor, a student assistant SI supervisor, part-time secretarial assistance, and SI leaders ($850 per course is the UMKC rate). However, these are variable costs since some institutions might have other ways to cover them. If a preexisting academic support program with full-time staff is already in operation on a particular campus, the program could be installed at a considerably lower cost. SI leaders can be paid through work-study, academic credit, partial tuition waiver, preexisting tutor budget, or other means. The program costs would vary by the number of SI courses and the rate of pay for SI leaders.

Longitudinal research studies suggest that SI increases both re-enrollment and graduation rates. (Please see data tables #8, #9, and #10). The following rationale illustrates the use of SI to increase enrollment and revenue.

1. During FY 1995-96, SI operated in 41 content courses. These 41 courses had a total enrollment of 3,637 students. Over 40 percent of these 3,655 students (1,454 students) attended SI review sessions during the semester.

2. Students who attended SI review sessions at UMKC re-enrolled and graduated at a rate ten percentage points higher than students who never attended SI review sessions. (See data tables #8, #9, and #10). Research suggests that the learning strategies and critical thinking skills students develop through SI are transferred to future academic work.
3. Applying the ten percent point difference between students who attended SI review sessions with students who never attended, one can infer that last year 145 students re-enrolled at UMKC that otherwise would have dropped out. (1,454 students x 10% = 145)
4. Minimally, the average undergraduate student (12 credit hours) spends $1,750 each year on tuition, fees, bookstore purchases and other related expenditures. Those 133 students provide $253,750 in additional revenue. ($1,750 x 145 = $253,750) Full time students in the professional schools average $4,000 in annual expenditures.
5. Each year new groups of first-year students attend SI sessions. Taking only the last four years, over 5,302 students have attended SI. As mentioned above, research suggests that nearly ten percent of students would have dropped out of the University had they not attended SI review sessions. Thus, some 530 additional students are now in the pipeline due to SI participation.
6. The economic impact of SI for these 530 additional students is considerable. With a minimal expenditure of $1,750 each year in tuition, fees, and other expenditures, the aggregate yearly impact is $927,500. This only assumes that the student persists for one additional year in school. The yearly impact would be

[page 9]

much higher if the student persisted longer than just one additional year, especially if the student graduated from the institution.

The economic impact with graduate and professional school students would be considerable since they are full-time and pay higher fees. Because of the nature of the curriculum which tracks cohorts of students through the academic program, students who withdraw after the first year in their program cannot be easily replaced by new students. The lost revenue from these empty seats in the cohort of students would continue until the entire group graduated from their program.

Evidence for Supporting SI Claims of Effectiveness

A. Claim Statements of SI

Claim 1. Students participating in SI within the targeted historically difficult courses earn higher mean final course grades than students who do not participate in SI. This is still true when differences are analyzed, despite ethnicity and prior academic achievement.

Claim 2. Despite ethnicity and prior academic achievement, students participating in SI within targeted historically difficult courses succeed at a higher rate (withdraw at a lower rate and receive a lower percentage of D or F final course grades) than those who do not participate in SI.

Claim 3. Students participating in SI persist at the institution (reenrolling and graduating) at higher rates than students who do not participate in SI.

B. Description of Methodology for Each Claim

1. Design

The basic design of the various quasi-experimental research studies compares performance of the voluntary treatment group (SI Participants) with the control group (Non-SI Participants). Additional analyses compare SI-participants and non-participants in terms of their motivation to participate, their prior academic achievement and their ethnicity. Dependent variables include final course grades, reenrollment and graduation rates. The research does not meet the standards for true experimental design, but results have been replicated across many institutions. For the foregoing analyses, all students within the targeted SI courses are included, both those enrolled in UMKC and those enrolled in other institutions where SI has been adopted and evaluative data have been collected. The first six sets of studies use data from the UMKC program: historical data (Table 3); disaggregation of data by motivational control group (Table 4); disaggregation of data by prior academic achievement (Table 5); disaggregation of data by ethnicity (Table 6); frequency of SI attendance upon mean final course grade (Table 7); and longitudinal follow-up (Tables 8, 9 and 10). Two sets of studies contain data from other institutions that have implemented SI: cross-institutional (Tables 11, 12, and 13); and disaggregation of data by ethnicity (Tables 14 and 15).

2. Population

The population studied for this report includes all students enrolled in courses in which SI was offered, those who participated in SI and those who did not. The population represents students from UMKC and from other institutions in the U.S. where SI has been adopted and effective data collection efforts have been made.

3. Instruments and Procedures

Course rosters and background data (e.g., ethnicity, standardized entrance test scores, high school rank) for students enrolled in SI targeted courses were obtained. A student survey was administered the first day of the course to find out the motivation level of the students concerning SI. Another survey was administered the last day of the course to gain information from SI-participants (e.g., evaluation of the SI program) and Non-SI participants (e.g., reason for not attending SI). Faculty members in the targeted courses provided a list of students and their grades on the first major examination in the course. Final course grades, reenrollment and graduation data for students were also obtained after the semester for students enrolled in the targeted classes.

[page 10]

The procedures followed at UMKC were recommended to other participating institutions. Due to differing administrative structures of the many schools participating in the study, not all were able to gather data in precisely the way that UMKC has recommended. However, all reported their data gathering procedures and evaluators determined that data included in the study were precise enough to meet reasonable standards.

4. Data Collection

The UMKC national SI director was in charge of all data collection and analysis. This person was responsible for the collection, analysis, writing, and distribution of periodic reports on the SI program's effectiveness. The national SI director receives the semester reports from the institutions that send reports to UMKC each year. A variety of instruments and procedures were used to obtain the information needed for an analysis of the data related to student enrollment in the targeted courses. The SI staff was carefully instructed in proper use of confidential student data. All university protocols were followed.

5. Data Analysis

Standard statistical methods were used in analysis of the data for

comparing students. The level of significance was set at p<.01 when independent t-tests were employed for comparing final course grades. A significance level of p<.05 was set when using the chi square tests for comparing the percentage of A and B final course grades; the percentage of D and F final course grades and withdrawals; and the percentage of reenrollment. The chi square level of significance was set at less than p<.01 for the graduation study.

With the chi square, using nominal data, this research study used p<.05 to heighten the sensitivity of the measures. If an effect were present, the researchers did not want to overlook it. On the other hand, when using interval data, the researchers sought to enhance the specificity of the statistical test, not wishing to claim an effect that may not have been present. Additionally, the researchers used p<.05 in measures there were thought of as a preliminary, screening test. In more precise efforts to specify effects, the researchers used p<.01.

C. Description of Results for Each Claim

Data from UMKC.

Study #1: Academic achievement for UMKC students enrolled in SI courses.

Since 1980, UMKC has offered SI in 375 courses at the undergraduate, graduate and professional school level. An analysis of data on grades and withdrawal rates (Table 3) found that the SI-participants: earned significantly higher percentage of A & B final course grades; significantly lower percentage of D & F final course grades and withdrawals; and significantly higher mean final course grades than the Non-SI participants. Each cell within Table 3 compared the SI and Non-SI groups. For instance, in 1995-96, 40 percent of the students in SI classes participated in SI; SI-participants had a higher percentage of A & B final course grades (71% vs. 49%), lower percentage of D and F final course grades and withdrawals (29% vs. 51%) and a higher mean final course grade (2.75 vs. 2.47) than non-SI participants. These results have been replicated each year in a variety of courses at varying levels at the institution.

[page 11]

Table 3: SI UMKC Data: FY 1980-81 to 1995-96 (N=375 SI Courses; 14,667 SI-Participants)

Year	SI Participation	SI Participation	Number of SI	Percent A & B	Percent D, F, &	Final Course

	Status	Percent/Number	Courses		Withdrawal	Grade
1995-96	SI Non-SI	40.0% (1,454)	41	52.0%* 37.8%*	21.6%* 39.6%*	2.64** 2.27**
1994-95	SI Non-SI	36.3% (1,328)	41	52.6%* 39.6%*	20.8%* 36.0%*	2.84** 2.69**
1993-94	SI Non-SI	38.1% (1,233)	40	49.0%* 37.1%*	23.1%* 38.2%*	2.52** 2.18**
1992-93	SI Non-SI	37.0% (1,287)	36	55.6%* 41.6%*	20.7%* 37.3%*	2.84** 2.50**
1991-92	SI Non-SI	39.5% (1,520)	27	56.4%* 41.5%*	19.2%* 34.1%*	2.69** 2.16**
1990-91	SI Non-SI	34.1% (774)	18	53.4%* 38.7%*	16.0%* 31.2%*	2.61** 2.23**
1989-90	SI Non-SI	30.3% (753)	19	58.3%* 41.9%*	16.7%* 34.8%*	2.70** 2.29**
1988-89	SI Non-SI	29.9% (614)	17	63.2%* 45.7%*	15.6%* 28.9%*	2.81** 2.39**
1987-88	SI Non-SI	34.1% (775)	24	60.4%* 43.8%*	13.7%* 28.9%*	2.80** 2.39**
1986-87	SI Non-SI	44.3% (778)	19	56.3%* 40.9%*	18.3%* 34.1%*	2.65** 2.41**
1985-86	SI Non-SI	39.1% (584)	16	51.5%* 41.2%*	18.7%* 28.7%*	2.55** 2.34**
1984-85	SI Non-SI	42.6% (788)	17	59.7%* 42.9%*	16.8%* 25.4%*	2.83** 2.27**
1983-84	SI Non-SI	34.1% (765)	19	54.5%* 39.5%*	17.3%* 29.5%*	2.76** 2.24**
1982-83	SI Non-SI	43.1% (1,119)	19	52.2%* 36.8%*	17.9%* 28.2%*	2.51** 2.07**
1981-82	SI Non-SI	40.9% (329)	5	58.2%* 38.5%*	20.9%* 26.7%*	2.61** 2.09**
1980-81	SI Non-SI	32.2% (566)	17	50.1%* 32.5%*	14.2%* 33.1%*	2.56** 2.16**

***Level of significance for differences: 0.05 using chi-square test. **Level of significance for differences: 0.01 using independent t-test.**

2. Study #2: Academic achievement for Non-SI motivational control groups.

To control for motivation level, all students were surveyed on the first day of class concerning interest in SI. Students were asked to rate their motivation to attend SI on a five-point Likert scale (5=high; 1=low). Since the scheduled times for the SI sessions were not announced until the second class sessions of the semester, students were not aware of any time conflicts. Students who selected "4" or "5" were designated as "highly motivated." During the last class period of the semester another survey was given to all students in the class. Students who did not attend any SI sessions during the semester were asked to select one of the designated choices for not attending SI. If a student selected either time conflict with work or with another college class, and had also indicated high motivation to attend SI on the first day SI survey, the student was assigned to the

[page 12]

Non-SI Motivational Control Group.

Creation of the Non-SI motivational control group permitted comparison across the three groups: SI Participants, Non-SI Participants (Motivational Control), and Non-SI Participants (All Others). The following differences were seen in the academic performance data in Table 4. Students using SI services: (a) have entry data (high school class rank percentile, and college entrance test scores) comparable to data of the other groups; (b) have significantly higher average course grades compared to both Non-SI groups ($p<.01$); and (c) have considerably fewer D and F grades and withdrawals than either of the Non-SI groups ($p<.05$).

While it is clear that the highly motivated perform at higher levels than the less motivated, motivation alone does not account for the majority of the differences between the SI and Non-SI students for the measures investigated. There are significant and substantial differences between the SI group and the motivational control group in both course grade and percent of unsuccessful enrollments.

Table 4: SI UMKC Data: Winter 1996 (N=1,593)
Comparison of SI Group, Non-SI (Motivational Control) Group, and Non-SI (All Others) Group

			Percent	

Student Group	Number of Students	Percent A & B Final Course Grades	D,F,&W Final Course Grades	Student Group
SI-Participant	739 (46.4%)	58.9%*	17.2%*	2.78**
Non-SI (Motivational Control)	56 (3.5%)	33.9%*	26.8%*	2.16**
Non-SI (All Others)	798 (50.1%)	42.7%*	38.6%*	2.38**

*Level of significance of difference: 0.05 using chi-square test. **Level of significance of difference: 0.01 using independent t-test.

Study #3: Academic achievement for students of differing previous academic achievement.

Data were analyzed to determine the utilization and effectiveness of SI services for students of differing previous academic achievement. Previous academic achievement was defined by high school (percentile) rank and mean composite score on a college entrance exam (e.g., American College Testing service). Students were divided into quartiles on the basis of their mean composite ACT score as compared with other UMKC students.

These data warrant the following observations. Students in the bottom quartile group used SI services at nearly the same rate as did students in the top quartile (Table 5). Despite quartile ranking, SI-participating students earned significantly higher grades than their nonparticipating counterparts. SI-participating students in the bottom quartile and the middle two quartiles reenrolled at the institution at significantly higher rates than their nonparticipating counterparts. While the SI and Non-SI groups of the top quartile reenrolled at 93 percent, the Top Quartile SI-participants received a significantly higher mean final course grade.

It is noteworthy that SI services appear to meet the needs of students with a wide range of previous levels of academic achievement within the same group setting, thus reducing the necessity for the institution to provide additional and separate tutorial programs.

[page 13]

Table 5: UMKC Students of Differing Levels of Previous Academic Achievement:

Fall Semester 1989 to Winter Semester 1990 (N=1,628)

Group Composition	Number of Students	Percentage of Students in Targeted Classes	High School Percentile Rank	Mean Composite ACT Score	Percentage Reenrolled Following Semester	Final Course Grade
Top Quartile, SI	112	32.9%	87.5	26.8	92.9%	3.29**
Top Quartile, Non-SI	288	67.1%	82.1	27.0	93.1%	2.83**
Middle Two Quartiles, SI	262	27.6%	68.7	21.3	90.5%*	2.67**
Middle Two Quartiles, Non-SI	687	72.4%	67.7	21.4	77.9%*	2.28**
Bottom Quartile, SI	104	30.7%	64.9	15.1	85.6%*	2.10**
Bottom Quartile, Non-SI	235	69.3%	63.5	15.7	77.9%*	1.77**

*Level of significance of difference: 0.05 using chi-square test. **Level of significance of difference: 0.01 using independent t-test.

Study #4: Academic achievement of African-American students.

Table 6 describes the academic performance of all 110 African-American students enrolled in 12 UMKC College of Arts and Science, School of Pharmacy and School of Basic Life Science courses that had SI attached during the 1987 Fall Semester. The data suggests that African-American students using SI when compared with Non-SI students of the same ethnicity had a significantly lower percentage of D and F final course grades and course withdrawals; and earned a significantly higher mean final course grade.

Table 6: Effectiveness of SI With UMKC African-American Students: Fall 1987 (N=110)

Group Composition	Number/Percentage of Students	Percent D, F, or W	Mean Final Course Grade

SI-Participant	39, 35.5%	31%*	2.2**
Non-SI Participant	71, 64.5%	46%*	1.8**

*Level of significance of difference: 0.05 using chi square test.
**Level of significance of difference: 0.01 using independent t-test.

Study #5: Frequency of SI attendance upon final course grade.

Research suggests that increased frequency of SI attendance correlates with higher final course grades (Table 7). Astin (1993) suggests that most educational outcomes are dependent upon both the frequency and the intensity of interactions and activities in the college environment.

The following table suggests that higher levels of SI attendance was positively related to higher final course grades. If students attended SI sessions twelve or more times, the mean final course grade was slightly lower that other SI attendance groups. However the 12+ attendees received a higher mean final course grade (2.64) than the non-SI attendees (2.37). Interviews with these SI attendees suggests that a large group were students who had planned to withdraw from the course, but persisted through frequent attendance at SI sessions.

[page 14]

Table 7: Frequency of SI Attendance Upon Mean Final Course Grades: Winter 1996 (N = 1,590)

Group Composition	Number Students	Percent A & B Final Course Grades	Percent D, F & W Final Course Grades	Mean Final Course Grade
Do Not Attend Any SI Sessions	854	42.2%**	39.3%**	2.37*
Attended One or More SI Session	736	59.1%**	18.2%**	2.79*
Attended 1 to 3 SI Sessions	378	56.3%**	21.4%**	2.77*
Attended 4 to 7 SI Sessions	189	63.0%**	17.4%**	2.82*
Attended 8 to 11 SI Sessions	102	63.7%**	12.8%**	2.88*
Attended 12 or More SI Sessions	67	56.7%**	10.5%**	2.64*

* Level of significant of difference: 0.05 using chi-square test when comparing non-SI participants and each of the SI-participant groups.
** Level of significance of difference: 0.01 using independent t-test when comparing non-SI participants and each of the SI-participant groups.

Study #6: Persistence rates of SI-participating students at the institution.

Research suggests that SI makes a positive difference in terms of increased reenrollment and college graduation (Tables 8, 9 and 10). The studies only consider UMKC students since other institutions have not yet reported on their own persistence studies. The reenrollment rates were significant at the $p<.05$ level and the graduation rate was significant at $p<.01$. Educational researchers have often cited academic success as an important factor to eventual college graduation (Tinto, 1987; Noel, et. al, 1985)

Table 8: Reenrollment Rates of UMKC Students Enrolled in SI Courses, Fall 1989 (N=1,689)

Group Composition	Number Students	Mean High School Rank Percentile	Reenrollment, Spring 1990
SI-Participant, Fall 1989	479	72.4	90.0%*
Non-SI Participant, Fall 1989	1,210	72.0	81.5%*

*Level of significance of difference: 0.05 using chi-square test.

Table 9: Reenrollment & Graduation Rates of UMKC Students Enrolled in SI Courses 1989 to 1996

Table 9: Reenrollment & Graduation Rates of UMKC Students Enrolled in SI Courses 1989 to 1996

Term SI Offered To Students	Term Examined for SI Impact	Student Group	Number Students	Graduation Percent	Re-Enrollment Percent	Graduation + Re-Enrollment Percent
Fall 89	Fall 90	SI Non-SI	386 923	7.8% 5.0%	65.3%* 56.7%*	73.1%* 61.7%*
Fall 90	Fall 91	SI Non-SI	529 1,162	5.9% 8.1%	70.1%* 58.3%*	76.0%* 66.4%*
Fall 91	Fall 92	SI Non-SI	795 1,085	4.8% 5.3%	70.6%* 63.6%*	75.4%* 68.9%*
Fall 92	Fall 93	SI Non-SI	639 1,221	8.6% 8.7%	70.6%* 53.6%*	79.2%* 62.3%*

Fall 93	Fall 94	SI Non-SI	699 1,221	5.2% 8.2%	73.4%* 55.3%*	78.6%* 63.5%*

Note: table continued on next page.

*Level of significance of difference: 0.05 using chi-square test.

[page 15]

Table 9 cont'd: Reenrollment & Graduation Rates of UMKC Students Enrolled in SI Courses 1989 to 1996

Fall 94	Fall 95	SI Non-SI	604 962	4.3% 5.1%	72.4%* 60.8%*	76.7%* 65.9%*
Fall 95	Fall 96	SI Non-SI	619 940	5.5% 7.3%	74.5%* 58.2%*	80.0%* 65.5%*

*Level of significance of difference: 0.05 using chi-square test.

Table 10: Graduation Rates of Fall 1989 UMKC First-Time, First-Year Students
Cumulative Graduation Rate By End of Four Time Periods

Group Composition	By Fall 1993	By Fall 1994	By Fall 1995	By Fall 1996
SI Participant	15.9%**	31.3%**	38.1%**	46.0%**
Non-SI Participant	12.3%**	21.1%**	27.4%**	30.3%**

**Level of significance of difference: 0.01 using chi-square test. Includes all UMKC First-Time, First-Year Freshmen who were not enrolled in professional degree programs. SI was offered in 19 courses during Fall 1983.

Data from other institutions that have implemented SI.

Study #1: Academic achievement for students from across the U.S. who were SI-participants.

Nearly one hundred colleges and universities submit data reports annually on their SI programs. The following tables were compiled from 270 institutions of varying types. They were selected since they had a sufficient number of SI's in place; had sufficiently rigorous data collection procedures; had transmitted their data to us in a timely fashion; they represented a cross section of institutions (Table 11 study: 931 courses from two-year public, 3,001 courses from four-year

those drawn from the UMKC campus: SI-participants received a higher final mean course grade ($p<.01$) and a lower percentage of D and F final course grades and withdrawals ($p<.05$).

Table 11

Table 11

National SI Field Data: FY 1982-83 to 1995-96
N=270 Institutions; 4,945 Courses; 505,738 Students)

Student Grades		All Institutions N = 4,945	Two Year Public N = 931	Two Year Private N = 20	Four Year Public N = 3,001	Four Year Private N = 993
Final Course Grade	SI Non-SI	2.42* 2.09*	2.56* 2.09*	2.55* 2.26*	2.36* 2.07*	2.55* 2.31*
Percent A & B Final Grades	SI Non-SI	46.8%** 35.9%**	50.2%** 32.4%**	53.1%** 38.9%**	53.1%** 38.9%**	52.1%** 43.2%**
Percent D, F, & W Final Grades	SI Non-SI	23.1%** 37.1%**	24.3%** 32.4%**	24.6%** 31.5%**	24.6%** 31.5%**	19.1%** 28.4%**

*Level of significance of difference: 0.01 using independent t-test. **Level of significance of difference: 0.01 using chi-square test.

[page 16]

Table 12
National SI Field Data: FY 1982-83 to 1995-96
(N=270 Institutions; 4,945 Courses; 505,738 Students)
Data Separated by Broad Academic Disciplines

Types of Courses		Percent A & B*	Percent D, F & W*	Final Course Grade**
All Courses N = 4,945	SI Non-SI p-value	46.8% 35.9% 0.01	23.1% 37.1% 0.01	2.42 2.09 0.01
Business N = 683	SI Non-SI	42.4% 32.9%	25.3% 38.5%	2.36 2.07

Health Science **N = 50**	SI Non-SI p-value	65.7% 55.3% 0.01	11.8% 16.6% 0.01	2.84 2.61 0.01
Humanities **N=268**	SI Non-SI p-value	54.5% 44.3% 0.01	18.1% 28.1% 0.01	2.61 2.35 0.01
Mathematics **N = 815**	SI Non-SI p-value	38.7% 32.2% 0.01	36.4% 48.7% 0.01	2.17 2.11 0.01
Natural Science **N = 1,761**	SI Non-SI p-value	46.4% 36.6% 0.01	22.4% 34.9% 0.01	2.41 2.11 0.01
Social Science **N = 1,235**	SI Non-SI p-value	51.1% 36.7% 0.01	18.4% 34.5% 0.01	2.52 2.12 0.01

*Using independent t-test. ** Using chi-square t-test. n.s. = not statistically significant

Table 13
National SI Field Data: FY 1982-83 to 1995-96 (N=270 Institutions; 4,945 Courses; 505,738 Students)
Data Separated by Academic Departments

Types of Courses		Percent A & B*	Percent D, F & W*	Final Course Grade**
All Courses **N = 4,945**	SI Non-SI p-value	46.8% 35.9% 0.01	23.1% 37.1% 0.01	2.42 2.10 0.01
Accounting **N = 271**	SI Non-SI p-value	45.9% 35.2% 0.05	30.0% 45.9% 0.05	2.49 2.17 0.01
Administration of Justice **N = 22**	SI Non-SI p-value	47.3% 33.6% 0.05	21.1% 31.5% 0.05	2.40 2.03 0.01
Algebra **N = 219**	SI Non-SI p-value	36.4% 27.9% 0.05	37.5% 52.7% 0.05	2.20 1.91 0.01
Anatomy/Physiology **N = 73**	SI Non-SI p-value	52.2% 39.8% 0.05	17.6% 31.2% 0.05	2.60 2.30 0.01
Art **N = 12**	SI Non-SI p-value	66.8% 49.9% 0.05	11.1% 24.4% 0.05	2.84 2.47 0.01

[page 17]

Table 13 cont'd

Types of Courses		Percent A & B*	Percent D, F & W*	Final Course Grade**
Biology N = 528	SI Non-SI p-value	45.5% 35.2% 0.05	21.8% 33.5% 0.05	2.39 2.12 0.01
Calculus N = 143	SI Non-SI p-value	43.1% 37.2% 0.05	32.4% 42.5% 0.05	2.26 2.06 0.01
Chemistry N = 718	SI Non-SI p-value	46.2% 36.9% 0.05	23.2% 36.5% 0.05	2.40 2.08 0.01
Economics N = 357	SI Non-SI p-value	40.3% 31.3% 0.05	23.7% 36.1% 0.05	2.30 2.02 0.01
Engineering N = 63	SI Non-SI p-value	37.8% 30.9% 0.05	33.3% 44.2% 0.05	2.16 1.91 0.01
Finite Mathematics N = 30	SI Non-SI p-value	45.6% 31.5% 0.05	30.4% 48.4% 0.05	2.32 1.88 0.01
Foreign Language N = 46	SI Non-SI p-value	46.9% 53.2% n.s.	24.7% 23.8% n.s.	2.43 2.56 n.s.
Geography N = 93	SI Non-SI p-value	46.4% 41.1% 0.05	21.1% 31.4% 0.05	2.40 2.22 0.01
Geology N = 44	SI Non-SI p-value	51.3% 41.9% 0.05	26.3% 28.8% 0.05	2.45 2.29 0.01
History N = 495	SI Non-SI p-value	52.1% 34.9% 0.05	18.9% 38.5% 0.05	2.54 2.06 0.01
Literature N = 67	SI Non-SI p-value	47.2% 32.1% 0.05	24.4% 43.9% 0.05	2.46 2.08 0.01
Marketing N = 9	SI Non-SI p-value	61.2% 34.3% 0.05	17.7% 39.5% 0.05	2.66 1.99 0.01
Mass Communications N = 15	SI Non-SI p-value	51.1% 40.9% 0.05	10.9% 20.7% 0.05	2.58 2.28 0.01
Medicine N = 10	SI Non-SI p-value	82.2% 64.1% 0.05	7.6% 18.3% 0.05	3.25 2.79 0.01
Music N = 22	SI Non-SI p-value	71.8% 54.1% 0.05	12.5% 26.5% 0.05	3.04 2.52 0.01

Physical Science N = 31	SI Non-SI p-value	37.9% 31.5% 0.05	29.0% 42.3% 0.05	2.23 2.02 0.01
Physics N = 129	SI Non-SI p-value	45.1% 35.9% 0.05	24.4% 36.9% 0.05	2.42 2.14 0.01
Political Science N = 154	SI Non-SI p-value	47.5% 37.7% 0.05	18.1% 34.5% 0.05	2.47 2.17 0.01
Quantitative Analysis N = 10	SI Non-SI p-value	42.2% 40.3% n.s.	20.0% 43.1% 0.05	2.54 2.35 0.01

[page 18]

Table 13 cont'd

Types of Courses		Percent A & B*	Percent D, F & W*	Final Course Grade**
Religion N = 35	SI Non-SI p-value	59.5% 45.6% 0.05	12.9% 22.6% 0.05	2.68 2.42 0.01
Psychology N = 304	SI Non-SI p-value	50.2% 37.2% 0.05	18.5% 32.6% 0.05	2.51 2.13 0.01
Sociology N = 139	SI Non-SI p-value	48.9% 37.2% 0.05	18.6% 31.5% 0.05	2.49 2.16 0.01
Speech Communications N = 17	SI Non-SI p-value	44.4% 35.5% 0.05	13.7% 25.2% 0.05	2.43 2.15 0.01
Statistics N = 80	SI Non-SI p-value	48.9% 41.7% 0.05	28.7% 38.2% 0.05	2.40 2.26 0.01
Zoology N = 33	SI Non-SI p-value	46.1% 30.5% 0.05	22.3% 39.9% 0.05	2.46 2.01 0.01

* Using independent t-test. ** Using chi-square test. n.s. = not statistically significant

Study #2: Levels of SI participation and academic achievement across ethnicities.

Data analyses were also used to find the utilization and effectiveness of SI services for students of differing ethnicities. A sample of 13 institutions was selected for analysis. The institutions were selected since: they had numerous SI's in place; had sufficiently rigorous data collection procedures; had transmitted their data to UMKC in a timely fashion; they represented a cross section of institutions (3 two-year public, 4 four-year private and 6 four-year public). Of the 2,410 SI-participants in the study, 2,111 were White and 299 were students of color. Data permit the following observations. Students of color used SI services at equal or higher rates than White students (Table 14). Despite quartile ranking (Table 15), SI-participating students of color earned higher grades than their nonparticipating counterparts ($p<.01$). SI-participating students of color (Table 15) received a lower percentage of D and F final course grades and withdrawals ($p<.05$) than their nonparticipating counterparts.

It is noteworthy that SI services appear to meet the needs of students with a wide range of previous levels of academic achievement and ethnicities within the college courses, thus reducing the necessity for the institution to provide additional and separate tutorial and academic support programs.

Table 14: Participation in SI By Differing Ethnicities: 1987 (N=13 Institutions; 2,410 SI-Participants)

White	African American	Latino	Asian/Pacific	Native American
33.8% (2,111)	42.0% (174)	50.9% (55)	33.3% (42)	42.9% (28)

[page 19]

Table 15: Effectiveness of SI With Differing Ethnicity and Levels of Previous Academic Achievement: Spring and Fall 1987 (N=13 Institutions, 299 Students of Color)

Group Composition	Percent D,F, & W		Mean Final Course Grade	
	SI	Non-SI	SI	Non-SI
All Students of Color	36%*	43%*	2.02**	1.55**
Lowest Quartile, Students of Color	Not collected	Not collected	1.87**	1.35**
Highest Quartile, Students of Color	Not collected	Not collected	2.64**	1.97**

*Level of significance of difference: 0.05 using chi-square test. **Level of significance of difference: 0.01 using independent t-

test.

Study #3: Examining the Role of "Double Exposure" to Course Content Material

One of the rival explanations for the impact of the SI program is that it is merely a "double exposure" to the course content material. According to this theory the professor makes an original presentation of the material in class and the SI leader merely relectures or reviews the same material a second time.

To test this theory two first-semester business calculus courses for business and economics majors at the University of Texas were selected for the study. The business calculus course fit the traditional definition of "historically difficult" since more than 30 percent of the students received a grade of D or F, or withdrew from the course before the introduction of the SI program. These two courses were taught by the same instructor. This helped the study to control for the effect of the instructor. The same student assistant served both courses. As with the instructor, this helped the study to control for the effect of the student assistant. In addition to attending class sessions led by the course professor, students were also required to attend an additional session each week. Students enrolled in each course had no statistically different characteristics from each group.

Through use of a coin flip, in one section of the business calculus course students would be required to attend an additional discussion session each week that was conducted in a traditional manner. The other section of the course the students would be required to attend an additional discussion session each week that was conducted using activities associated with Supplemental Instruction. In the traditional discussion sessions the student assistant performed the typical role of most discussion leaders (e.g., answering questions from homework assignment, clarifying concepts from lecture material, conducting test review sessions). In the other section of the course the student assistant performed the role of SI leader (e.g., integration of study strategies along with review of content material, work with practice tests, post-examination surveys, sharing by SI leader and others in the review sessions of successful learning strategies). To ensure that the activities in the discussion groups were qualitatively different between the "traditional" and SI-style sessions, observations were conducted by two mathematics educators throughout the academic term. The observers used a specific rating sheet to ascertain that the activities in the two groups were significantly different from each other so that the student outcomes from the control (traditional teaching assistant) and treatment (SI-style) could be appropriately compared and evaluated.

Using regression analysis, attendance in the SI-style discussion sessions was found to be a statistically significant variable in suggesting why these students earned higher final course grades than students in the traditional sessions. More information on this study can be found in the dissertation research conducted in 1989 by Dr. Patricia Kenney. (Dissertation Abstracts for Social Sciences, 50, DA8909688).

D. Summary of Supplemental Evidence for Each Claim

UMKC received the highest rating for its student retention program by a national jury of experts during the 1990 competition sponsored by the Noel-Levitz National Center for Student Retention. SI is the major retention program at the University, at the undergraduate, graduate and professional school level. Previously, SI had received an award from the National Association for Student Personnel Administrators. Several recent monographs describe the customization of SI in specific academic disciples. One monograph was published by the National Center for The Freshman Year Experience (Martin, Arendale, & Associates, 1992) and another was published by Jossey-Bass Publishing (Martin & Arendale, editors, Winter 1994). The University of Louisville is another example of where SI has been successfully implemented. The SI program at the University began with one SI course and grew to over 30 per semester. The program is jointly funded by several campus departments. One of the departments offered financial support to SI because of the positive results experienced by minority students. A survey of first year students in Spring 1991 reported that 85 percent of them listed SI as important to their school retention. SI is a major part of the retention program at Louisville. They received the 1991 National Noel-Levitz Retention Award.

E. Interpretation and Discussion of Results

1. Relationship Between Effect and Treatment

SI research methodology has accounted for the students' profile (e.g., previous levels of academic achievement, standardized test scores, high school rank, ethnicity, motivation level) when comparing SI participants and non-SI participants. Research suggests that there is no significant difference between the two groups in terms of what they bring to the classroom and their participation percentage with SI. Final course grades, reenrollment rates and graduation rates are used as the evaluation criteria for effectiveness. With respect to each dependent variable, the differences favored the SI group.

While success varies among and between SI programs, UMKC is not in possession of data that would suggest that SI has any major limitations. However, SI is more difficult in content areas where prerequisite skills are a key variable. For example, if students do not remember any algebra, they will have a particularly difficult time in chemistry. SI can be and is effective in these areas, however. It just takes more time planning by the SI leader. The clearest evidence UMKC has found is the uneven level of success when SI is attached to a developmental course. Sometimes students refused to attend since the course was not considered demanding or historically difficult by students. After that experience, UMKC has made a point of stressing to adopting institutions that they choose courses that were considered by students and faculty to be historically difficult.

SI has not been effective for students who cannot read, take lecture notes, write,

or study at the high school level. Writing includes note taking and expository writing on essay tests. Thus, SI is most effective in non-remedial settings. Currently, UMKC has developed an adaption of SI, Video-based SI (VSI), which helps students compensate for severe underpreparation in reading and writing. Students who have found success with VSI include inner-city high school students, rural high school students, community college students, college student athletes, and academic probationary college students.

The SI model needs to be slightly modified in courses that are problem based and involve practice for mastery. In those circumstances, SI sessions need to be more frequent and sometimes longer in length. For example, a three credit-hour accounting course where practicing problems is crucial would need to have SI meet often enough so that every type of problem could be reviewed. A similar example would be a calculus class. SI would have to afford adequate time for modeling and practice. Frequently, offering SI more times a week and carefully structuring the SI sessions achieves this goal.

[page 21]

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2. Control of Four Rival Hypotheses

a) Is there something different about SI participants that helps to explain why they have higher academic outcomes?

This first question examines the demographics of students who chose to attend or not to attend SI sessions. The question concerns whether there are statistically significant differences between the SI participating and non-SI participating students. Studies found that there were no statistically significant differences in participating and non-participating students regarding gender, age, working status, high school rank, standardized test scores, ethnicity, or other factors. In addition, studies have been conducted of the motivation level of students and whether this would have a statistically significant impact upon student academic performance. Table 4 contained a comparison across three groups: SI Participants, Non-SI Participants (Motivational Control) and Non-SI Participants (All Others). The "motivational control" group was composed of students who at the beginning of the academic term expressed high interest in attending SI but were unable to participate due to a time conflict (e.g., another class at same time, work commitment). The data suggests that the motivational control group received academic grades similar to the other Non-SI (All Others) group rather than grades associated with the SI-participants. The research suggests that motivation was not the primary variable in accounting for higher academic performance.

b) Is it possible that the academic discipline or the course professor is a significant factor in explaining the differences between SI and Non-SI participants?

SI has been offered in a very heterogeneous environment: 5,000 SI courses; a variety of types of post-secondary institutions (two year/four year, public/private, large/small); institutions located throughout the United States; a

variety of academic disciplines; a variety of courses within academic disciplines; many classroom professors; SI at the undergraduate, graduate and professional school level; many SI leaders; and many SI supervisors. The statistically significant results are consistently the same: higher grades, lower percentage of course withdrawals and higher reenrollment rates for SI-participants when compared with Non-SI participants (please see Tables #11, #12 and #13).

c) Is the impact of SI due to a double exposure to the content material (once by the professor and once by the SI leader) and not through the SI session strategies facilitated by the SI leader?

Research from the University of Texas examined this question and found that SI session activities were unique in their statistically significant impact upon raising student academic performance in comparison with students enrolled in classes that provided only traditional discussion sessions that reviewed the material a second time. This research was previously discussed in this paper.

d) Is there long term positive effects of the SI program?

Data from UMKC suggests that SI contributes significantly to higher reenrollment and graduation rates (Tables # 8, #9, and #10). Other UMKC studies suggest that after the introduction of SI for a course, the rate of D, F final course grades and withdrawals was consistently and significantly lowered as long as the SI program was provided for the course. If SI was withdrawn from the course, the levels of D, F and Withdrawals increased to similar levels before the introduction of SI to the course. A third way to examine the long term impact of SI is to see if there was a transfer effect to other individual courses that SI participants enroll. A research study at UMKC examined a group of pharmacy majors who were enrolled in a sequence of two biology courses over succeeding academic terms. The first biology course had SI offered in connection with it. No SI was offered with the second biology course in the sequence the following academic term. There were no statistically significant differences between the two groups of pharmacy majors (e.g., standardized test scores, high school rank, cumulative GPA) except that the SI participants

[page 22]

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earned higher final course grades than the non-SI participants in the first biology class. In the second biology class the former SI participants earned higher mean final course grades than the non-SI participants. The research suggests that the SI participants used learning strategies from the first course and applied them to the second course. Qualitative research studies conducted at UMKC and other institutions suggest that students transfer the learning strategies learned through the SI sessions to other courses in the same and succeeding academic terms.

F. Educational Significance of Results
1. Relationship of Results to Needs

Differences in course grades and attrition rates between SI participants and non-

participants have implications for student retention at the University. Students who do better academically are more likely to reenroll at the University during subsequent semesters and graduate than students who do less well (Tinto, 1987; Noel, et. al., 1985). Data from UMKC suggests that SI contributes significantly to higher reenrollment and graduation rates (please see Tables # 8, #9, and #10).

A college degree is an important economic and social resource for the graduating students. Pascarella and Terenzini's most recent book, How College Affects Students (1991), reviewed and reanalyzed almost 3,000 studies concerning the impact of college on students. College graduates earned between 18.3 and 46.5 percent more than those with only high school diplomas (p. 501). This was true despite ethnicity and gender (pp. 522-527). Besides the economic benefits, Pascarella and Terenzini suggested that there were social and self-esteem benefits as well. "Independent of an individual's background, a bachelor's degree confers about a 34 percentile point advantage in occupational status or prestige over and above graduating from high school" (p. 488). A college degree was also an important economic resource for the community in two ways. The first was that the graduate was more likely to earn more, spend more (recycling the money back into the community) and pay more taxes. The second was that the graduate will have general education skills that are needed to make them more flexible in terms of employability over high school graduates. College graduates are less likely to suffer long-term unemployment and underemployment. This would reduce the need for the state support with welfare and unemployment benefits. Pascarella and Terezini's research study does not suggest that everyone should try to be a college graduate, but the data suggests that almost everyone could benefit from a college degree. It does appear reasonable to say everybody who could get a college degree and wants to complete a degree, should have access to a college degree. The goal of SI is to provide every opportunity for students to place themselves within the "could" category.

Because of the contributing effects of SI on the continued reenrollment and persistence toward graduation of SI participating students, the institution receives more revenue from these persisters than the financial investment in implementing the SI program. This is an important side benefit of SI during these times of restrictive funding for higher education. The SI program provides a wise investment of limited funds.

2. Comparison of Results to Results from Other Programs

In a review of the professional literature concerning tutoring, Maxwell (1990) made the following observations: some studies find that high ability or more experienced students benefit most from tutoring (p. 2); it is rare for studies to show that tutored students improved their grades (p. 2); and that there is no evidence that tutoring helps the weakest students (p. 4).

UMKC actively encourages SI program directors on other campuses to share their own perception of and experiences with SI. Following is a list of benefits attributable to SI by others in the higher education field. SI promotes the development of leadership and communication skills (Dr. William Eddy, Dean of the Bloch School of Business, University of Missouri-Kansas City). SI experience enables graduate students to be more competitive for top scholarships

or positions (Dr. Joan Dean, Co-Director of the UMKC Academic Honors Program). SI experience has been responsible for attracting SI leaders into the field of education (Sally Richardson, Kingston Polytechnic College, England). SI has facilitated faculty cooperation and professional

[page 23]

development with the faculty and staff (Jeanne Carter, Oakland University, Rochester, MI and Jean Jubelirer, Milwaukee Area Technical College, Milwaukee, WI).

Since SI is one academic treatment that is academically beneficial and attracts students in nearly equal percentages from different ethnicities and previous academic achievement levels, the institution can reduce expenses since they do not have to maintain duplicate programs for each student subpopulation. No other student academic support program has the wide appeal with a research-based strategy for learning and success.

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[page 24]

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[page 25]

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