Increasing Efficiency and Effectiveness of Learning for Freshmen Students Through Supplemental Instruction

David Arendale
University of Missouri-Kansas City
5115 Oak Street, AC 336E
Kansas City, MO 64110
816-235-1197 (Work)
913-789-8314 (Home)
816-235-6502 (Work FAX)
arendaled@umkc.edu

Abstract

Developmental educators have a historic opportunity to reinvent themselves as resources for the entire campus -- students and faculty alike -- in partnering with the new enriched learning environment. The learning process must be expanded beyond the traditional classroom walls. Additional partners must be added to the learning environment.

The Supplemental Instruction (SI) program serves as a catalyst for an improved and effective learning environment. SI is flexible to meet the learning needs of students and compliment an enriched learning environment managed by the classroom professor. Through its use, the efficiency and effectiveness of learning can be improved.

A New Emphasis for Higher Education

Some educational leaders proclaim a new emphasis is taking root in higher education. They expose the time honored myth that teaching and learning are two sides of the same coin. How can we be teaching if students are not learning, as the old saying goes? The answer is simple: Some students are ready for the curriculum; others are not. Unfortunately, the typical professor cannot design the perfect lesson that will bridge the gap among the students in class, and cannot construct or buy the perfect test that will show the differences. Therefore, if it is all up to them, higher education must admit defeat.

This new change in emphasis of the education model is reflected in several areas. The first area concerns the central focus of education. Rather than the traditional teacher-centered model, the focus shifts to being learning-centered. Instead of the focusing on the broadcaster of information, it is now on effectiveness of the transmission process. The traditional instructional model encourages an increase in the quantity of information that is presented to students and use of new instructional technologies to transmit it. After a long period of focusing energies and committing scarce resources to improving teaching, many bruised and battered educators are turning their attention to improving the efficiency and effectiveness of the learning environment. Rather than examining how much information was delivered, the question is how much does the student understand. This new emphasis embraces the appropriate use of state-of-the-art technology to enhance instruction delivery. But not to the extent that students are overwhelmed with content without a corresponding learning environment that insures mastery learning.

A second dimension of the new education model regards measuring the effectiveness of education. Have students deeply understood and mastered the material? Can students demonstrate this knowledge through the ability to discuss the material in their own words and to be able to transform it into novel applications and expressions? The traditional periodic major examinations, although perhaps effective in assessing the degree to which students have copied a field of data, are insufficient measures of this level of learning. The new model uses continuous classroom assessment through both formal and informal means to provide feedback to both the students and the instructors concerning the effectiveness of the learning. The old model made the assumption that if teachers broadcast information, it would be received

by students. Students are more complicated that television sets that receive programs from the broadcasters.

If the first dimension recognizes that professors cannot deliver the perfect lecture and the second recognizes that there is no perfect test, the next dimension of the new model is more personal. The first two dimensions tell us that we must change what we do. The third tells us we must recognize who our students are and we must change the way we think about ourselves and our students. The changes are more than demographic. They include that the gender balance is shifting and that the mean age is rising. Many students expect relevance of the course material and bring a wealth of personal experiences to the classroom that they want to integrate with the course material. Traditional aged students come from secondary education where collaborative learning activities have accustomed students to working in small groups and engaging in peer discussions regarding course material. Although previous generations of students took seriously the admonition that required three hours of preparation for each hour in class, a growing number of the present generation expect satisfactory grades, with or without understanding, with minimal preparation since higher education is just one part of their busy lives. Many students have a low tolerance for frustration, and delayed gratification is a foreign concept. Some students view themselves as "consumers" who have "purchased" a product (traded tuition dollars for a college degree) and expect it to be delivered to them in an acceptable fashion. They have high expectations regarding support services to make the process convenient and trouble-free. We do not have to approve or support these expectations or behaviors, but it is critical that we understand their perceived needs.

Role of Developmental Education with the Changing Education Model

As the focus of education shifts from the professor to the learner, developmental educators have a historic opportunity to reinvent themselves as resources for the entire campus -- students and faculty alike -- in partnering with the new enriched learning environment. The learning process must be expanded beyond the traditional classroom walls. The new process must be released from the shackles of the fixed number of traditional class time periods. Additional partners must be added to the learning environment in addition to the classroom professor. Developmental educators are vital change agents in renewing the learning environment.

Rather than being marginalized, the learning assistance profession is an essential partner within the campus learning community. The following vision statement was developed by the National Association for Developmental Education, "By 2003, NADE will be a nationally recognized association of professionals with expertise to help students academically succeed throughout the entire educational experience from high school through college and graduate/professional school." Building upon service to developmental education students, many NADE leaders at the local, state, and national level encourage developmental educators to expand their mission to support learning achievement by all students, not just those at the margins of academic success.

The first year of college has always presented challenges to both students and institutions. For students, it is one of life's most critical transitions. The student attrition rate of nearly 50 percent for the first year college student is a national trend among two-year institutions. These rates have increased at many institutions over the past

decade except those with highly selective admission policies (American College Testing Program, 1997). Moreover, most institutions are faced with severe budget constraints and limited flexibility in assigning personnel to student retention activities. For these reasons, institutions have to be very careful in assigning limited resources to meet students' needs.

Effective models of retention stress the need for students to be integrated into the academic and social dimensions of the college community (Tinto, 1993). These connections need to be established during the first weeks of their first year of college. This interpersonal support system is important for all first year students, despite their background and experience.

In addition to concern for students dropping out of the institution, there is the additional problem of students shifting out of college majors due to academic difficulty. There has been particular concern with student persistence in mathematics, science and engineering for all student subpopulations, particularly females and students of color. Some researchers have found a positive correlation between persistence in science major course work and involvement in study groups outside of class for female students (Shlipak, 1988). Researchers suggest that increased student involvement is an important strategy to help stem the drop out rate for all science and math students (Hilton and Lee, 1988).

Developmental education professionals have many of the skills needed for improved learning enrichment and higher graduation rates of students. Some of those skills include: academic assessment, counseling, academic advisement, developing high school/college bridge programs, classroom assessment techniques, instructional technology, use of collaborative peer-assisted learning, adapting instruction to meet affective domain needs of diverse students, curriculum development, program evaluation, and many others. These skills uniquely position developmental educators to expand the services of their centers or departments to a wider group. Georgia State University has moved from being a traditional developmental class and tutoring center and have expanded to include course-related services such as Supplemental Instruction and linked-courses (Commander, et al., 1996, Stratton, et al., 1997).

Numerous developmental education centers have been transformed into full service learning and teaching centers. Rather than focusing exclusively with developmental students, these departments have changed their mission. This "value-added" mission expands service for all students, not just those at the institution's margins who have traditionally received additional help -- the developmental and the gifted students. In addition, some of these expanded centers also provide faculty development services as well. An overview of some of these centers is provided through the NADE home page (http://www.umkc.edu/centers/ cad/nade/nadedocs/lrnteacn.htm). Some of the common practices of these expanded centers include using academic support programs to provide requested feedback to course professors, publishing teaching effectiveness newsletters, conducting learning effectiveness workshops, providing teaching mentors, and consulting on instructional delivery innovation.

Some programs report innovative means to facilitate faculty development activities concurrently as the faculty members participate in learning assistance activities. The Educational Development Center at Central Missouri State University coordinates the campus new student orientation course for hundreds of students each year. While the

course obviously has benefit for the students, one of the original purposes of the course was for faculty development. Instructors for the course are drawn from volunteers throughout the campus. Many of them are faculty members who receive additional funds that can be used for various professional development activities (e.g., journal subscriptions, conference registrations) in lieu of extra pay. In addition, orientation teachers gather on a weekly basis to discuss common course issues and share strategies on effective teaching.

Overview of Supplemental Instruction (SI)

Many developmental educators possess knowledge and skills to improve the effectiveness and efficiency of the learning environment. One of the learning assistance programs that offer diverse opportunities of service to the campus in enriching the learning environment is Supplemental Instruction (Martin and Arendale, 1994). Supplemental Instruction (SI) is used by more than 800 campuses in the U.S. and twelve countries to provide an enriched learning environment for students to increase mastery and understanding of content material from historically difficult courses. There are more than 350 citations in the professional literature concerning the use of SI in the U.S. and abroad (Arendale, 1997). The SI program was created at the University of Missouri-Kansas City in 1973 by Dr. Deanna C. Martin. Extensive literature regarding SI can be found at its web site: www.umkc.edu/cad/si.htm

SI is a student academic assistance program that increases academic performance and retention through its use of selected collaborative learning and study strategies. The SI program targets traditionally difficult academic courses, those that typically have 30 percent or higher rate of D or F final course grades and/or withdrawals (e.g., algebra, chemistry, anatomy). SI provides regularly scheduled, out-of-class, peer-facilitated sessions that offer students an opportunity to discuss and process course information (Martin and others, 1977).

SI Addresses Needs of New Education Emphasis Areas. The SI program is responsive to the new education emphasis areas described at the beginning of this paper. SI sessions are extensions of the classroom where students continue the learning process initiated by the professor (Wilcox, 1995). Rather than being limited by the prescribed classroom time, students are able to attend SI sessions as often as they desire throughout the academic term to receive the assistance that they desire and to engage in intellectual inquiry. Students receive continuous feedback regarding their comprehension of the classroom material, thereby giving them opportunity to modify their study behaviors before major examinations are administered by the professor. Immediate feedback received during SI sessions enables students to quickly modify study behaviors to adapt to the academic rigor and requirements of the course. Many students are responsive to SI since perceive that their need for academic assistance is met in the sessions. Professors participate in the SI program at the level that they choose. Some faculty members report significant professional development opportunities for themselves that are described later in this paper.

SI Program Activities. Assistance begins in the first week of the term. The SI leader -- a former successful student of the same class -- introduces the program during the first class session and surveys the students to establish a schedule for the SI sessions. Attendance is voluntary. Students of varying abilities participate, and no

effort is made to segregate students based on academic ability. Many underprepared students who might otherwise avoid seeking assistance will participate in SI since it is not perceived to be remediation and there is no potential stigma attached. Such unintended stigmas can cause motivation problems for developmental students (Somers, 1988). SI is a cost-effective program both in comparison with one-on-one tutoring programs and increasing student persistence/graduation rates (Martin and Arendale, 1993).

Glendale Community College (Glendale, CA) has reported good success with SI in calculus courses. Some student comments are illustrative of the benefits of the SI sessions. "What I really liked about the SI was that if I had any questions, Dr. Kolpas or the other helpers didn't tell us the answer. Instead, they let us think about the problem, set it up, and solve it ourselves. I also liked the one-on-one help and the friends I made." "Having more opinions and minds to work a problem helped a lot. The groups discussed problems from many different points of view." (Allen, Kolpas, and Stathis, 1992, p. 9). Some UMKC students noted that the learning environment in SI provided a comfortable place for them. One UMKC SI leader said, "Students realize at the SI sessions what they do not understand; after determining this, students are less likely to be intimidated and more eager to tackle the more difficult concepts. A UMKC sophomore student stated, "I felt comfortable about being wrong in front of other students in SI sessions, no insecurities." A first year student at Colorado State University said it this way, "SI gives us a chance to talk about the problem and to work through it ourselves instead of the professor telling us what it ought to be. You work it yourself. This way it sticks in your mind."

Concurrent Development of "What to Learn" and "How to Learn It". SI sessions provide a way to integrate "what to learn" with "how to learn." SI allows students to develop the needed learning strategies while they are currently enrolled in college degree credit courses. SI avoids the remedial stigma often attached to traditional academic assistance programs since it does not identify "high-risk students" but identifies "historically difficult classes". SI is open to all students in the targeted course; therefore, prescreening of students is unnecessary. Since the SI program begins the first week of the academic term, the program provides academic assistance during the critical initial six-week period of class before many students face their first major examination. Attrition is highest during this period (Noel et al., 1985).

Focus on Historically Difficult Courses. Historically difficult courses often share the following characteristics: large amounts of weekly readings from both difficult textbooks and secondary library reference works, infrequent examinations that focus on higher cognitive levels of Bloom's taxonomy, voluntary and unrecorded class attendance, and large classes in which each student has little opportunity for interaction with the professor or the other students. Researchers (Christie and Dinham, 1991) have concluded that it is difficult to rely solely upon the analysis of high school grades and standardized college entrance examination scores to accurately identify all students who will withdraw from college. Less than 25 percent of all students who drop out of college due so because the institution has academically dismissed them (Tinto, 1993). Many leave the institution due to extreme difficulty and frustration in high risk courses.

Such a designation of historically difficult for a course makes no prejudicial comment about the professor or the students. It is a numerical calculation that suggests many students have difficulty in meeting academic requirements for the class. Rather than blaming the students or the professor, the designation suggests that additional academic support is needed for students to raise their level of academic performance to meet the level deemed appropriate by the classroom professor. In recent years, the popular and professional literature has been replete with extensive discussions about who is at fault for the perceived lower quality of student academic achievement. SI bypasses this issue and provides a practical solution that helps students meet the professor's level of expectation.

Key SI Program Personnel. There are key persons involved with SI on each campus -- the SI leaders, the SI supervisor, and the course instructors. Each plays an important role in creating the environment that allows the SI program to flourish.

The SI leader is a student who has successfully completed the targeted class or a comparable course. It is ideal if the student has taken the course from the same instructor for whom he or she is now providing SI assistance. The SI leader is trained in proactive learning and study strategies and operates as a "model student," attending all course lectures, taking notes, and reading all assigned materials. The SI leader conducts three or more out-of-class SI sessions per week during which he or she integrates "how to learn" with "what to learn".

The SI leader is a facilitator, not a mini professor. The role of the leader is to provide structure to the study session, not relecture or introduce new material. The SI leader should be a "model student" who shows how successful students think about and process course content. He or she facilitates a process of collaborative learning, an important strategy since it helps students to empower themselves rather than remain dependent as they might in traditional tutoring. Research suggests that tutoring relationships do not always promote transfer of needed academic skills (Keimig, 1983).

A central responsibility of the SI leader is to integrate study skills with the course content. As someone who has performed well in the course, the SI leader has displayed mastery of the course material. However, it is important for the SI leader to share his/her learning strategies with the other students in the SI sessions. If the students only learn content material and not the underlying study strategies, they will have a high probability of experiencing academic difficulty in succeeding courses. The integration of study skills with the course content is a key difference between SI and other forms of collaborative learning. It is not just that students are working together. It is the planned integration and practice of study strategies that sets SI apart. By combining "what to learn" with "how to learn it", students can develop both content competency and transferable academic skills. SI sessions capitalize on the use of the "teachable moment" to apply and model learning strategies with the course material.

SI provides many opportunities to address study skills within the content of the course. Research has shown that teaching study skills in isolation from content has little impact on the students' academic performance (Dimon, 1988; Keimig, 1983; Stahl, Simpson, and Hayes, 1992). While students can be taught elaborate note-taking and text-reading strategies, these skills are not necessarily put to use in courses that they subsequently take. Also, it is likely that different classes will require different note-taking styles and a science text is used differently from a social science text. As SI

leaders model appropriate questioning and reasoning, students begin to internalize aspects of thinking strategies that will carry over into their individual and group study.

A qualitative study from the United Kingdom (Ashwin, 1993) suggested the following benefits to SI leaders from their participation in the program: increased confidence, greater understanding of course material, increased interest by potential employers due to cocurricular nature of SI leader experience. Maloney (1992) reported the use of the SI leader experience as an alternative field experience for secondary education majors prior to student teaching.

The second SI program partner is the SI Supervisor. This college faculty or staff person has received formal training to serve as the supervisor to the SI program. Responsibilities for the SI supervisor include: selecting courses for support, hiring SI leaders, supervising SI leaders, and completing evaluation reports every academic term that SI is offered. An old adage goes, "you cannot expect what you do not inspect." Supervision of SI leaders during their SI sessions is critical. It is not enough to conduct an initial workshop before the term begins and then have a party at the end. SI leaders need helpful feedback from the SI Supervisor concerning the behaviors that occur during the SI sessions: appropriate modeling of study strategies, allowing students to help develop the session agenda, insuring that the SI leader does not talk too much, using effective collaborative learning strategies to encourage active learning, and other behaviors.

The third key person with the SI program is the faculty member. SI is only offered in connection with classes that have the full support of the classroom instructor. Instructors can choose their level of involvement with the SI program. At a minimum, the instructor makes an announcement at the beginning of the academic term endorsing the SI program and encouraging the participation of all students. Some instructors spend a few minutes each week with the SI leader reviewing SI session plans. Increasing levels of involvement could lead to the instructor helping the SI leader prepare mock practice exams or practice problems.

Jean Jubelirer, campus SI Coordinator for Milwaukee Area Technical College (WI), finds the collaborative nature of SI very powerful. The SI program started with two classes in 1989 and now operates in 13 classes each term. The program serves over 1,000 students each year. Jubelirer says that SI helps to form learning communities composed of the SI leader, participating students, and the classroom instructor. Strong bonds are formed among all three. Beyond quantifiable results of increased course grades and persistence, students frequently comment on the impact of the SI program with them personally. Faculty members appreciate support for their classes as SI leaders help students to learn material presented in class lectures.

SI Adds Value to the Professor's Lecture and Assigned Readings.

SI adds value to the professor's lectures and assigned readings through the out-of-class, peer facilitated review sessions. As one United Kingdom student said, "the fact that SI sessions followed lectures added value." Professors have an ever expanding knowledge base to consider as they deliver their lectures and make reading assignments. Since the number of class periods will not increase, strategies must be developed to help manage student study time outside of class to help master the instructional content.

The SI leader can mentor the students in using strategies that the leader previously found helpful with the course material. This is why it is critical that the SI leader attends class with the students. The students need specific assistance with the day's reading material and lecture notes besides appropriate use of study skill strategies. SI activities can enhance both study skills and comprehension of the course content. It is generally not advisable to label these activities study skill instruction, but rather to weave skills into the context of the course material. SI leaders need to recognize the "teachable moment" and introduce or model the appropriate skills, tying them directly to the content review. Often these discussions last only a few minutes at most. Several examples of how this can be accomplished are noted here.

Processing lecture notes requires students to consider the adequacy of their own note-taking techniques. It quickly becomes evident to many of them that there may be a better method for recording what the professor said than the one they presently use. SI leader suggestions might include use of summary margin notebook paper (which has a wide left margin), recopying notes that are particularly difficult to decipher, writing potential test questions that can be used for reviewing the material in their notes, correlating notes with outside reading assignments, and highlighting notes when appropriate. In addition to modeling strategies by the SI leader, others in the study group are encouraged to share their methods as well.

Students find that organizing and processing information during the SI session is a very beneficial experience. They see that course content is manageable and that with some work and mutual support, they can make sense out of even the most difficult material. One SI participant said that SI sessions, "clarified things in your own mind if you had to explain it." A student at UMKC said this about them actively listening during the SI sessions, "From the other people talking, I get a better understanding than what I get in the lecture. The other students put it into better words."

After each exam, the SI leader can guide the group in going over the questions that were particularly troublesome. This process reinforces the correct answers on the exam and gives the students a chance to examine how they interpreted the questions; how they derived the answers; and if they made an error, why they made it.   Reviewing the test will also help students to understand more thoroughly the kinds of questions the professor asks and to predict future test question more accurately. This activity helps students to develop a perspective similar to the professor concerning the important things in the class. Sometimes the student who attempts to act as a stenographer and record every statement made in the course can have the same level of academic difficulty as those who take few notes. The ability to value and prioritize information is an important skill as well as the ability to quickly record notes of live lectures or from textbooks.

If the textbook includes graphs, charts or diagrams, it is important that the students do not omit these aids from their study of the materials. Occasionally, when graphs are used extensively, it is appropriate to review how to read and interpret graphs, as well as review the material they contain.

Text reading efficiency can be enhanced through a procedure called "reciprocal questioning" (Martin and Blanc, 1984). In brief, a small section of the text is selected for silent reading. Then both the SI leader and the students take turns asking and answering questions. When students become active readers, as this procedure

requires, they find that the time they must spend in re-reading material is greatly reduced because they comprehend more information during their initial reading.

At times during the term it will be helpful to direct the students' attention back to the course syllabus. From the syllabus students can anticipate the dates of future tests and the amount of material to be covered between tests. Some discussion can result that will include tips on time management.

SI as a Follow-up to the Freshman Year Experience.

The SI program is uniquely suited to serve as a companion of a campus First Year Experience Program: immediate application of learning strategies to content courses; formation of learning communities composed of students who seek higher academic achievement; solves common factors in student attrition; and meets or exceeds academic expectancy levels of historically difficult first year courses (Martin and Arendale, 1993). SI is an excellent follow up activity for students who have participated in first year experience programs. SI provides a supportive environment for the immediate application and use of study strategies that were discussed or demonstrated during those programs.

A challenge for first year student programs that are conducted before the beginning of the academic term is that they often rely on lectures concerning study strategies. These instructional sessions are therefore isolated from the actual content material in college courses. Students often feel frustrated when faced with abstract lectures concerning study skill instruction that is dissociated from college content material. Rather than seeing the need for such instruction, many students associate study skill strategy review as appropriate for "other students," those who need remedial or developmental assistance. Students perceive a vested interest in study skill strategies when the skills are directly applied to content courses that the students are currently taking. Faced with an impending exam, students are receptive when they might otherwise be uninterested.

Use of SI for Faculty Development and Renewal

In addition to serving students to increase their retention and understanding of course material, the SI program has been effectively used for faculty development and renewal. Faculty can choose to do one or more of the following: adopt strategies used in the SI sessions during regular class time; receive informal feedback from the SI sessions concerning what the students understand and need additional assistance with; and learn new strategies as they serve as mentors to the SI program student leaders. Additional benefits mentioned by Australian faculty members include: increased rapport with students, membership in national and international SI network, increased recognition from their colleagues, additional opportunities to obtain grant funds, and increased satisfaction with their teaching role (Gardiner, 1996).

Angelo (1994) identified several barriers to development of effective faculty development programs: most efforts focus primarily on improving teaching, and only secondarily, if at all, on improving learning; many programs do not recognize the importance of discipline-specific "ways of knowing," teaching, and learning; many teachers fail to recognize the need for development of their own teaching; and many faculty development programs are not planned and organized for success.

One of the strengths of the SI program is that faculty members select their level of involvement. Professors can select from the following three broad areas of participation. The first is to receive anonymous feedback from SI leaders regarding student comprehension. This gives them an opportunity to revisit previous lectures for review/clarification and to modify future lectures. It is difficult for students to reveal their ignorance or lack of understanding to a person who has placed great effort in delivering carefully crafted lectures. Students do not want to share that they do not understand the lecture with the person who also determines their final grades and whether they pass on to the next class or not. Use of the SI program as a feedback loop is frequently used in Australia and the United Kingdom.

The second level of involvement is to incorporate SI strategies into class period activities (Martin, Blanc, & Arendale, 1994). Faculty member may attend a portion of the SI leader training workshop to learn how to adopt these activities for in-class use. SI activities often used by SI leaders could be used by faculty members as well: give the "big picture" of the course throughout the academic term, illustrate the "messy" process of solving problems and thinking about issues, refer to the syllabus throughout the academic term, provide an early "low impact" exam to provide feedback regarding comprehension before the first major exam, organize course content through visual tools (e.g., matrix boxes), and be explicit about expectations for excellence.

The third level and highest level of involvement is for the faculty member to co-plan activities that occur inside the classroom and within the out-of-class SI sessions. Faculty members might also serve as SI supervisors and provide helpful feedback to the SI leader and perhaps the faculty member for whom the SI class is provided.

Following are several examples of how SI can be used in a carefully planned manner to foster self-development of faculty members.

Wolfe (1990) describes the use of SI at Anne Arundel Community College (Arnold, MD) to provide services for both students and faculty members. Some faculty members serve as SI supervisors. Faculty have several options to earn promotion credit for increased salary. One of which is to earn "professional development credit." Faculty who choose this option and are approved by the SI program help supervise the SI leaders (Wolfe, 1990). A faculty member who agrees to serve in this role is called a "Faculty Mentor". Wolfe received a grant from the Fund for the Improvement of Post-Secondary Education to initially implement this activity. Since the conclusion of the grant, the institution has continued the mentor faculty program.

An important feature of this program is that the faculty members supervise SI leaders in areas outside their content specialty. The faculty members focus on general learning skills, and not on critiquing the content of the instructor for which the SI is being offered. These faculty mentors attend classes and SI sessions with student SI leaders for the first four weeks of the term; these teachers become students in the course, attending class and taking notes with the SI leader. Before the SI review sessions, these master teachers, as skills specialists, work with the SI leaders, the content specialists. They prepare materials and plan activities. Following SI sessions, mentors offer constructive comments.

As students in a class that is outside their discipline, these faculty mentors have the opportunity to observe and learn different approaching and teaching techniques. They may also become a nonthreatening resource for integrating study skills into course

lectures, readings, and assignments. Reported changes in behavior by the classroom teacher and the Faculty Mentor occur in three areas: procedural strategies (e.g., include board work and handouts, refer to course syllabus throughout the term), study strategies (e.g., classroom assessment techniques, review to reinforce major points), and group interaction (e.g., redirect questions back to other students or to the textbook, coach problem-solving among small groups).

Marshall (1994) reported on the use of SI for faculty enrichment at Salem State College. There was frequent interaction between faculty members and SI leaders through joint participation in SI leader training workshops, monthly meetings to discuss pedagogical issues, and weekly meetings to discuss SI participant comprehension level of in-class material. Faculty members reported numerous changes in their behaviors and improved attitudes.

Research Findings Concerning SI

The U.S. Department of Education has designated SI as an Exemplary Educational Practice and has validated the following three research findings: (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. (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. (3) Students participating in SI persist at the institution (reenrolling and graduating) at higher rates than students who do not participate in SI.

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). All final course grades were based on a 4.0 grade scale (4=A; 3=B; 2=C; 1=D; 0=F). 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. Dozens of research studies from UMKC, the national database from 270 institutions, and other studies from individuals campuses are available through the SI home page: www.umkc.edu/cad/si.htm Following are three studies that illustrate the variety of research studies: frequency of SI attendance and final course grades; graduation rates of UMKC students; and final course grades of students from a national study of nearly 5,000 reports of SI use with classes that had a total enrollment of over one-half million students.

The data suggests that increased frequency of SI attendance has a relationship with higher final course grades (Table 1). One unexpected results of the research was that 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.

_____

Insert Table 1 About Here

_____

The data suggests that SI makes a positive difference in terms of increased college graduation rates (Table 2). 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 $p<.01$.

_____

Insert Table 2 About Here

_____

Nearly one hundred colleges and universities submit data reports annually on their SI programs. The following table was compiled from 270 institutions of varying types. These institutions submitted nearly 5,000 individual studies concerning the use of SI in classes with a combined enrollment of over one-half million students. The institutions were selected since they had a sufficient number of SI's in place; had sufficiently rigorous data collection procedures; had transmitted their data in a timely fashion; and they represented a cross section of institutions (Table 3). These findings are similar to those drawn from the UMKC campus: In comparison with their non-SI counterparts, SI-participants received a higher final mean course grade ($p<.01$) and a lower percentage of D and F final course grades and withdrawals ($p<.05$).

_____

Insert Table 3 About Here

_____

A variety of research studies have been conducted concerning the SI model by educators outside of UMKC. One of the most rigorous was a regression analysis conducted by Kenney (1989). Three variables were found significant at the .05 level: SAT math score, number of times students attended SI sessions, and whether they were a SI participant or not. Studies have been conducted of SI in other countries: United Kingdom by Bidgood (1994); Sweden by Bryngfors and Bruzell-Nilsson (1997); and Australia by Hamilton, et al. (1994).

Conclusion

It has been nearly two decades since Supplemental Instruction first appeared in higher education. After starting at the University of Missouri-Kansas City in 1973, SI has been implemented at a variety of institutions across the United States and around the world. Borrowing ideas from developmental psychology, SI encourages students to become actively involved in their own learning. By integrating appropriate study skills

with the review of the course content, students begin to understand how to use the learning strategies they have heard about from teachers and advisors. As new educational theories and practices have surfaced, the SI model has been adapted to incorporate the best in educational research.

The SI program serves as a catalyst for an improved and effective learning environment. SI is flexible to meet the learning needs of students and compliment an enriched learning environment managed by the classroom professor. It extends the classroom learning environment and helps to manage student study time to maximize its use to master difficult course material. SI serves as a valuable partner to increase the efficiency and effectiveness of learning.

References

Allen, M., Kolpas, S., and Stathis, P. (1992, October). "Supplemental Instruction in Calculus [SIC] at a community college," Collaborative Learning Exchange, 8-9.

American College Testing Program. (1997). ACT Institutional Data, 1997. Iowa City, IA.

Angelo, T. A. (1994). "From faculty development to academic development," American Association of Higher Education Bulletin, 46 (10), 3-7.

Arendale, D. (Ed.). (1997). Annotated bibliography of Supplemental Instruction and Video-Based Supplemental Instruction. Unpublished manuscript, Center for Supplemental Instruction, The University of Missouri-Kansas City.

Ashwin, P. W. H. (1993). Supplemental Instruction: Does it enhance the student experience of higher education? Unpublished doctoral dissertation, Kingston University, London, England.

Bidgood, P. (1994). The success of Supplemental Instruction: Statistical evidence. In C. Rust, & J. Wallace (Eds.), Helping students to learn from each other: Supplemental Instruction (pp. 71-79) Birmingham, England: Staff and Educational Development Association.

Bryngfors, L., Bruzell-Nilsson, M. (1997). Supplemental Instruction: An experimental project with the method of SI. Lund, Sweden: The Lund Institute of Technology and The Faculty of Science.

Christie, N.G., and Dinham, S.M. (1991, July/August). "Institutional and external influences on social integration in the freshman year," Journal of Higher Education, 62 (4), 412-436.

Commander, N. E., Stratton, C. B., Callahan, C. A., & Smith, B. D. (1996). A learning assistance model for expanding academic support. Journal of Developmental Education, 20 (2), 8-10, 12, 14, 16.

Dimon, M. (1988). "Why Adjunct Courses Work." Journal of College Reading and Learning, 21, 33-40.

Gardiner, R. (1996). Supplemental Instruction: A cost-effective, student-centered collaborative learning program. Paper presented at The Second International Open Learning Conference held in Brisbane, Queensland, Australia, December 4-6, 1996.

Hamilton, S., Blakeley, R., Critchley, C., Playford, J., Kelly, B., McNamara, E., & Robertson, R. (1994). Supplemental Instruction at the University of Queensland: A pilot program. Brisbane, Queensland, Australia: University of Queensland.

Hilton, T.L., and Lee, V.E. (1988, September/October). "Student interest and persistence in science: Changes in the educational pipeline in the last decade," Journal of Higher Education, 59 (5), 510-526.

Keimig, R.T. (1983). Raising Academic Standards: A Guide to Learning Improvement. ASHE-ERIC Higher Education Report No. 4, Washington, D.C.: Association for the Study of Higher Education, ED 233 669.

Kenney, P. A. (1989). Effects of Supplemental Instruction on student performance in a college-level mathematics course (Doctoral dissertation Ph.D., The University of Texas at Austin, 1988) Dissertation Abstracts International, 50 (02), 378A (University Microfilms, No. 8909688)

Maloney, R. S. (1992). The Supplemental Instruction program as an alternative field experience for secondary education majors. Unpublished undergraduate honors thesis (Bachelor of Science with Honors in Education), University of New Orleans, LA.

Marshall, S. (1994). Faculty development through Supplemental Instruction. In D. C. Martin, & D. Arendale (Eds.), Supplemental Instruction: Increasing achievement and retention (pp. 31-40). San Francisco, CA: Jossey-Bass, Inc.

Martin, D. C., & Arendale, D. (Eds.). (1994). Supplemental Instruction: Increasing achievement and retention (New Directions for Teaching and Learning No. 60). San Francisco, CA: Jossey-Bass, Inc.

Martin, D. C., & Arendale, D. (Eds.). (1993). Supplemental Instruction: Improving First-year Student Success in High-risk Courses. (2nd ed.). Columbia, SC: National Resource Center for The Freshman Year Experience and Students in Transition. (ERIC Document Reproduction Service, No. ED 354 839).

Martin, D.C., and Blanc, R.A. (1984). "Improving comprehension through reciprocal questioning," Life Long Learning, 7 (4), 29-31.

Martin, D. C., Blanc, R., & Arendale, D. (1994). Mentorship in the classroom: Making the implicit explicit. Teaching Excellence, 6 (1), 1-2.

Martin, D. C., Lorton, M., Blanc, R., & Evans, C. (1977). The learning center: A comprehensive model for college and universities. Kansas City, MO: University of Missouri, (ERIC Document Reproduction Service No. ED 162 294.

Noel, L., Levitz, R., Saluri, D., and Associates. (1985). Increasing Student Retention: Effective Programs and Practices for Reducing the Dropout rate. San Francisco: Jossey-Bass, Inc.

Rust, C., & Wallace, J. (Eds.). (1994). Helping students to learn from each other: Supplemental Instruction. Birmingham, England: Staff and Educational Development Association.

Shlipak, A.M. (1988). Engineering and physics as cultural systems: Impressions of science students at Harvard/Radcliffe. Thesis submitted to the Harvard University Department of Anthropology for the degree of Bachelor of Arts with Honors, March 26, 1988.

Somers, R.L. (1988). Causes of Marginal Performance by Developmental Students. Boone, NC: National Center for Developmental Education, Appalachian State University.

Stahl, N.A., Simpson, M.L., and Hayes, C.G. (1992, Fall). "Ten Recommendations from Research for Teaching High-risk College Students." Journal of Developmental Education, 16 (1), 2-4, 6, 8, 10.

Stratton, C. B., Commander, N. E., Callahan, C. C., & Smith, B. D. (1997). From DS to LS: The expansion of an academic preparation program from developmental studies to learning support. Selected Conference Papers of the National Association for Developmental Education (pp. 42-44). Mobile, AL: University of South Alabama.

Tinto, V. (1993). Leaving College: Rethinking the Causes and Cures of Student Attrition. (2nd ed.). Chicago: The University of Chicago Press.

Wilcox, F. K. (1995). Supplemental Instruction and efficiency in learning. In M. T. Keeton, B. Mayo-Wells, J. Porosky, & B. Sheckley (Eds.). Efficiency in adult higher education: A practitioner handbook (pp. 102-107). College Park, MD: The University of Maryland University College, Institute for Research on Adults in Higher Education.

Wolfe, R. (1990, Spring/Summer). "Professional development through peer interaction," The Journal of Professional Studies, 14 (1), 50-57.

Table 1: 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 Sessions	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 the baseline non-SI participant group and the individual SI-participant group.
** Level of significance of difference: 0.01 using independent t-test when comparing the baseline non-SI participant group and the individual SI-participant group.

Table 2: 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 1989.

Table 3: National SI Field Data: FY 1982-83 to 1995-96
N=270 Institutions; 4,945 Courses; 505,738 Students [Includes SI & Non-SI Participants]

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.