



Increasing Students' Success: When Supplemental Instruction Becomes Mandatory

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*Russ Hodges,
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Increasing
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The effectiveness of making Supplemental Instruction (SI) a required part of a history class and mandating student participation was compared to the Kansas City model of 1-hour sessions held several times each week outside of class for interested students. The researchers compared mean final course grades in U.S. History and semester grade point averages (GPA) for 432 students in three groups: students enrolled in a mandatory SI history section ($n = 108$), students enrolled in three regular SI history sections who attended SI voluntarily ($n = 105$), and students enrolled in the three regular SI history sections who did not attend SI ($n = 219$). Students in both mandatory and voluntary SI groups earned significantly higher course grades and semester GPAs than students in the non-SI group; however, there was no significant difference between participation in mandatory SI or voluntary SI groups for these two outcomes.

An exuberant history instructor, seeing the positive effect of SI on students' grades during the previous semester, challenged the premise that student participation in Supplemental Instruction (SI) must be voluntary. The instructor posited that if it worked for some students, it may work for many and approached

the campus learning center with the idea of devoting an hour of her class time each week to SI. This study is a result of her efforts to support her students' academic success.

The Traditional SI Model

Supplemental Instruction, developed by researchers in 1973 at the University of Missouri-Kansas City (UMKC), is a structured form of peer teaching in which students voluntarily seek academic support from peers to increase their academic performance in a difficult class. Peer teaching, incidentally, had its beginning in the great city states of Greece, where Aristotle is reported to have used "archons or student leaders who took care of the many details for him" (Wagner, 1982, p. 8). In SI, the peer teacher, called the "SI leader," is usually an undergraduate student who was successful in the course and was recommended by a faculty member to lead weekly review sessions. The SI leader collaborates with the instructor, attends course lectures, takes notes, completes assigned readings, and then schedules three or four 50-minute SI sessions each week at times convenient to the majority of the students in the course (Blanc, DeBuhr, & Martin, 1983). The SI leader is specifically trained in proactive learning and study strategies and is considered the facilitator of the group, not a mini-professor. His or her role is to provide structure to the study session, not to relecture or introduce new material (Arendale, 1994). SI is designed to assist students in mastering course concepts and to increase students' competency in reading, reasoning, and study skills (Blanc et al., 1983).

The SI model was developed in response to the high attrition rates occurring at UMKC. In 1981, the SI program won certification by the United States Department of Education (USDOE) as an Exemplary Educational Program. SI is one of two programs certified by USDOE as both increasing college student academic achievement and graduation rates. With this award, SI became eligible for funds from the National Diffusion Network (Widmar, 1994). According to the Center for Supplemental Instruction (2000), educators from UMKC have trained learning assistance personnel and faculty using the SI model from more than 900 colleges and universities in the United States and 12 other countries.

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Arendale (1994) described SI as avoiding the remedial stigma often attached to academic assistance programs because it identifies high-risk courses rather than high-risk students. High-risk courses, as defined by UMKC, have 30% of students earning Ds, Fs, or Ws. Student attendance in SI is voluntary and open to everyone in the targeted course.

So why challenge the premise that SI attendance be voluntary, especially with the success educators are experiencing with the current SI model (Anker, 1991; Blanc, et al., 1983; Kochenour, Jolley, Kaup, Patrick, Roach, & Wenzler, 1997; Romoser, Rich, Williford, & Kousaleous, 1997)? Trends in help-seeking research suggest that some students do not seek out academic assistance or voluntarily participate as readily as others, particularly low achieving students. In one study, the rate of help-seeking was low for students making high grades and low grades; however, help-seeking increased among students making average grades (Karabenick & Knapp, 1988). This study was consistent with Rosen (1983), who reported that help-seeking was curvilinear, that is, higher when the need was moderate and lower when the need was either very high or very low. Freidlander (1980) also indicated that less than 25% of low ability students in a special admissions program sought assistance from academic-related support programs and that continuing students were more likely to utilize these services than first-time freshmen.

Some educators have tried incentives to encourage students to attend academic support programs, but these methods, based on several research studies, have received mixed results. Reitinger and Palmer (1996) found that offering extra course credit for a psychology course by requiring students to attend 90% of the scheduled SI sessions resulted in less than 10% of the students choosing to attend SI. Allen, Kolpas, and Stathis (1992) investigated mandatory versus voluntary SI attendance for Calculus I classes at a community college. Students in the mandatory classes received a 10% increase in their grade as a reward for participating in SI. Final course grades for the mandatory group were 20% higher than the voluntary SI group. In a second experiment, instructors integrated SI strategies into Calculus I classes. Comparisons of students' grades were made to regular Calculus I classes; students in the modified sections earned a mean final course grade of nearly a letter grade higher than students in the regular sections.

In another study (Hodges, 1997), attendance in SI was unaffected when high-risk students were exposed to weekly verbal prompts and required to self-monitor their SI attendance for extra credit. Participants in the treatment group were compared to high-risk students not

receiving the treatment, and no significant difference in attendance was found between the groups. However, students who did attend SI were more successful in the targeted courses than non-SI attendees. Webster and Dee (in press) reported similar results on high-risk and at-risk students enrolled in an introductory engineering course. Only half chose to participate in SI, but they earned higher grades than their counterparts.

Educators have investigated factors that influence student attendance in academic support programs. Based on student surveys and interviews, Hodges (1997) reported that students attributed their non-participation in SI and tutoring to time conflicts and having unrealistic positive perceptions regarding their own academic abilities and skills. False feelings of success led students to believe that they did not need additional academic support.

Other research on noncognitive factors have been reported in the literature. For example, student participation may be influenced by factors such as locus of control, self-efficacy, and self-esteem. In a study by Visor, Johnson, and Cole (1992), students with an internal locus of control were likely to participate in SI as were students with the highest self-esteem. The researchers found that high-risk students—those with an external locus of control, low self-efficacy and low self-esteem—did participate in SI, but their attendance was sporadic and they ceased to participate after only a few sessions.

Studies on students' motivation and SI participation suggest that motivation alone does not account for the significant differences in student outcomes in SI and non-SI groups. Blanc et al. (1983) studied over 700 students in the entry-level courses in four academic disciplines at UMKC. The students were divided into three groups: (a) SI (i.e., attended one or more times); (b) Non-SI Motivational Control Group (i.e., on a Likert scale indicated a high interest in attending but could not because of a work conflict or another class conflict); and (c) Non-SI Other (i.e., not attending for personal or other reasons). Differences in the performance data showed that the SI students had similar college entry data to those in both non-SI groups; their average GPAs for the semester were significantly higher than both non-SI groups; their average course grades for the semester were significantly higher than those of both non-SI groups; fewer D and F grades and fewer Ws were recorded by the SI group than in both non-SI groups. Blanc et al. found that the differences between the SI group and the motivational control group were significant in course grade, in semester GPA, and in percentage of unsuccessful enrollments.

Still, educators wanted further exploration into why SI participants

academically outperform their fellow students, and they continued to grapple with the issue of motivation and experimental design. In one study (Center for Supplemental Instruction, 2000) baseline data were developed before SI was introduced. Several grade distributions of the same professor for the same class were studied. Because professors vary in their choice of criteria and in their grading, a baseline was completed to compare academic performance before and after SI was created for each professor's class. The introduction of SI resulted in significant differences in performance outcomes for the SI group. When the lack of an SI leader removed the SI component from the class, the performance outcomes returned to the baseline profile suggesting that other variables in the class did not change. Returning to the baseline also suggests that students other than those who receive high grades are attracted to the program.

In another study (Center for Supplemental Instruction, 2000) researchers developed a quasi-experimental protocol (in conjunction with the Program Effectiveness Program of the U.S. Department of Education) to help measure the role played by students' motivation in their success. In Winter 1996, all UMKC students enrolled in courses with SI were surveyed (using a Likert scale) on the first class day before SI session times were announced to determine their interest in attending SI. The session times were not announced until the second class day, so those students were unaware of any time conflicts. The students were surveyed again on the last class day of the semester; those who did not attend SI were asked to select from the list of choices a reason for not participating. Students who selected a time conflict with another class or work and who on the first survey had shown a high degree of motivation to attend were designated as the Non-SI Motivational control group. The resultant three groupings (SI, Non-SI control group, and Non-SI) showed significant differences. The SI group had higher average course grades and fewer Ds, Fs or Ws than both Non-SI groups. Significant differences in course grade and in the percent of unsuccessful enrollments were shown between the SI group and the control group, which could not solely be accounted for by motivation.

Kenney (1988) used a "double exposure" to course content, a related issue to motivation, to see if this might be the most significant variable. Kenney conducted the study at the University of Texas at Austin where students were assigned to one of two groups with mandatory attendance: a traditional discussion group and a discussion group incorporating SI methods. The group using SI methods emerged with higher performance.

Based on the previously reviewed studies, the authors found mini-

mal research on the effect of mandating students into academic support programs, particularly low achieving students. Furthermore, the current UMKC SI model does not endorse mandating students into SI programs. This study challenges the premise that for SI to be an effective academic intervention, students must participate voluntarily.

Method

The study was conducted at a large state university in the southern United States enrolling approximately 21,000 students during the fall, 1994 semester. Freshman students were admitted to the university based on two performance measures: high school rank and standardized test scores on the Scholastic Aptitude Test (SAT) or American College Test (ACT). Freshman applicants who were in the top three quarters of their classes, and whose high school rank and test scores placed them near the general admission requirements, were eligible for an individual review. Students whose academic record demonstrated potential for academic success at the institution were offered admission. Approximately one-third of the freshman class entered the institution under individual review.

Subjects consisted of 432 students who self-enrolled in four sections of U.S. History, a high-risk, required, freshman-level, writing-intensive course. The four sections were taught by different instructors and all used a standard course syllabus with the same objectives and expected outcomes. In three class sections, SI was conducted using UMKC's SI model of 1-hour sessions held several times each week outside of class for interested students. However, in one class section, SI was integrated into the class curriculum. The instructor lectured twice each week for 50 minutes (on Monday and Wednesday), and then 10 undergraduate SI leaders conducted one 50-minute SI session each week (on Friday) in various rooms on campus during the scheduled class time. The 108 students enrolled in this class were divided into 10 groups with 10 to 12 students per group.

All of the SI leaders in this study were undergraduates and attended 3 days of training using UMKC's SI model. In addition, SI leaders attended regularly scheduled weekly meetings with the SI director, the course instructor, or both. Each SI leader was also observed at least three times during the semester by the SI director or staff to provide feedback and facilitate their growth as an SI leader. Seventy-nine percent of the students were freshmen. More females (64%) were represented in the sample than the 54% in the general university population. Minority participation was 26% and reflected more closely the institution's minority enrollment. Eighty-five percent of the students

were traditional-age, and 70% were admitted to the university under regular admission standards, which also mirrors the university's general population. The average Scholastic Aptitude Test (SAT) composite score of the participants was 893 compared to the university-wide average of 900.

To assess possible differences in academic motivation among the three groups, the researchers administered a pre- and post-motivation survey during the first and last weeks of the semester. The researchers selected the *Academic Motivation Scale*, a 20-item survey using a 9-point Likert scale, constructed and validated by Baker and Siryk (1984). The items pertained to academic motivation such as personal standards regarding academic motivation, academic values and interest, diligence in meeting past academic obligations, attitudes toward intellectual activity, self-assessment of aptitude and preparedness for college work, interest in the particular institution the students would be attending, and future plans requiring academic effort. In order to accommodate the institution's computerized scanning format, the researchers reduced the 9-point Likert scale to four points (strongly agree, agree, disagree, strongly disagree); however, this did not affect the instrument's reliability. Baker and Siryk obtained a coefficient alpha reliability of 0.88 on the 9-point scale, and the current researchers obtained 0.874 on the 4-point scale.

In this study, the independent variable consisted of the three groups: mandatory SI, voluntary SI, and non-SI. To be included in the voluntary SI group, students attended at least one SI session. The two dependent variables were final course grades and semester GPAs. Using analysis of variance (ANOVA), and when appropriate *post hoc* comparisons, the researchers compared mean final course grades in U.S. History and semester GPAs for the three groups. ANOVAs, chi-square analyses and *post hoc* comparisons were also used to test for between-group differences. Data for the study were analyzed using the CRUNCH (Crunch Software Corporation, 1991) statistical processing program.

Limitations

This study has the limitations of many studies conducted in the naturalistic setting of a university environment when investigating a particular academic support program's effect on students' academic success. The study was conducted at a single institution, whereby it may be difficult to generalize the results to other institutions. The participants were not randomly assigned into groups; students self-selected their history sections. In addition, other academic support programs were available to all participants (the learning center, the writing center, tutoring, etc.).

Some of the variability may also be due to differing instruction by faculty members. In particular, the instructor mandating students into SI had to condense her 3 hours of lecture into 2 hours each week. These students were given additional readings not covered in class, and SI leaders facilitated students' discussions over these readings, thereby giving these SI leaders an additional responsibility not given to the other leaders.

Findings

Participants

Because students self-selected into the U.S. History sections, statistical analyses were conducted to determine initial differences among the groups. Males were underrepresented in all three groups: 32% were in the mandatory group, 25% were in the voluntary group, and 43% in the non-SI group. A chi-square analysis found a significant relationship ($p=0.0042$) between the groups and gender; the pattern of percentages seem to indicate that fewer males chose to voluntarily attend SI, which was unexpected by the researchers. Minority student representation for the sample was 26%. Using chi-square analysis of groups by ethnicity, no significant relationship was found. Most participants were traditional age and the mean ages were: 19.1 for the mandatory group, 18.3 for the voluntary group, and 19.8 for the non-SI group. Results of a one-way ANOVA indicated significant differences between groups. A post hoc comparison indicated that students in the voluntary group were slightly younger than the other groups ($p=0.0103$). As mentioned previously, approximately one-third of each freshman class entered the institution under individual review, and the participants in this study reflected this admission practice. The majority of students were admitted under regular university admissions standards: 61% for the mandatory group, 68% for the voluntary group, and 65% for the non-SI group. No significant relationship was found between groups' admission status using a chi-square analysis.

Because SI targets high-risk courses rather than high-risk students, the researchers' expectations of similar SAT composite scores among the groups were confirmed. The mean scores were 895 for the mandatory group, 871 for the voluntary group, and 904 for the non-SI group; a one-way ANOVA found no significant difference. However, the same expectation of similarity in high-school rank, a secondary measure of academic preparedness used by the institution to determine admission eligibility, was not confirmed. A one-way ANOVA of mean high school rank resulted in significant differences ($F=3.63$, $df 2, 392$, $p=0.0274$). *Post hoc* (i.e., Bonferroni) comparisons revealed that stu-

dents' high school rank in the voluntary group, with a mean rank of 72.88, was significant ($p=0.0301$) over students in the mandatory SI group (67.36), and the non-SI group (69.10).

Motivation of Subjects

Common concerns about higher motivation levels of participants in traditional SI programs prompted the researchers to measure the academic motivation of all students before and after conducting the SI intervention. A comparison of initial motivation levels of the three groups using a one-way ANOVA found significant differences. Post hoc comparisons revealed that motivation scores were significantly higher for the SI voluntary group when compared to the mandatory SI and non-SI groups (see Table 1).

Table 1
Pre-Motivation Survey (N = 422)

Group	M	SD
Mandatory SI <i>n</i> = 108	53.22*	7.89
Voluntary SI <i>n</i> = 100	56.07	7.23
Non-SI <i>n</i> = 214	52.45**	7.44

Note. ANOVA ($F=7.91$, df 2, 419, $p=0.0004$); Bonferroni *Post Hoc* (* $p=0.0443$, ** $p=0.0002$)

The follow-up measurement of motivation at the end of the semester, and subsequent comparison of mean scores with another one-way ANOVA and *post hoc* comparisons, revealed that students in the voluntary SI group maintained their higher motivation level over students in the mandatory SI group throughout the study. However, motivation scores for students in the non-SI group was no longer significantly different from the voluntary group. Fewer students took the post-test in the non-SI group which may have influenced the outcome (see Table 2).

Table 2
Post-Motivation Survey (N = 314)

Group	M	SD
Mandatory SI n = 94	52.64*	8.63
Voluntary n = 84	55.63	7.96
Non-SI n = 136	53.77	7.62

Note. ANOVA: ($F = 3.13$, $df 2, 311$, $p = 0.0450$); Bonferroni Post Hoc : ($*p = 0.0406$)

Final Course Grades

In order to test for significance between all three groups, grades were converted into numeric values using a traditional 4-point scale (A = 4 points, B = 3, C = 2, D = 1, F = 0, and W = missing data). A mean was calculated for each group based on the numeric value assigned to each student's grade. The mandatory group had a mean of 2.74, the voluntary group had a mean of 2.49, and the non-SI group had a mean of 2.13. A one-way ANOVA for course grades found significant differences ($F = 13.30$, $df 2, 383$, $p = 0.0000$). Post hoc (i.e., Bonferroni) comparisons revealed that grades were higher for the mandated group when compared to the non-SI group ($p = 0.0000$); and the voluntary group's grades were higher than the non-SI group ($p = 0.0136$).

Percentages of ABC versus DFW history grades for students differed considerably. Students in the mandatory SI group obtained the highest percentage (91%) of As, Bs, and Cs, followed by students in the voluntary SI group (81%) and the non-SI group (59%). The corresponding DFW rates for the three groups were 9%, 19%, and 41%, respectively.

Semester GPA by Group

Semester GPA means for students in the three groups were as follows: mandatory group was 2.70, voluntary group was 2.70, and non-SI group was 2.36. Because course grades contribute to GPA, the expectation that mandatory SI participants would earn higher GPAs than non-participants was supported by a one-way ANOVA result ($F = 11.16$ $df 2, 425$, $p = 0.0000$) and post hoc (Bonferroni) comparisons ($p = 0.0004$). In addition, GPA significance occurred for students in the voluntary group

compared to the non-SI group ($p=0.0005$), but there were no differences between GPAs earned by students in the mandatory and voluntary groups.

Discussion

One major result of this study confirmed previous SI research findings; students who participated in SI earned higher course grades and semester GPAs than students who chose not to participate. As expected by the researchers, motivation was higher for students who participated voluntarily in SI. Educators have long argued that students who participate voluntarily in academic support programs such as SI are likely to be more motivated for college, and because they are more motivated, they are more successful academically.

The second and most intriguing finding was that students mandated into SI were less motivated, but performed as well academically as students who participated voluntarily. It seems logical that students forced to do something might rebel, and SI leaders indicated that many students were not overly enthusiastic about attending mandatory SI sessions once every week. Attendance was mandatory as stipulated by the instructor; SI absences would lower students' grades. One possible explanation for the success rate of the mandatory group was their regular weekly attendance in SI; they were required to attend 13 SI sessions throughout the semester. The researchers did not conduct a correlation analysis on SI attendance rates between groups; however, few students in the voluntary group attended more than 10 SI sessions. Additionally, the researchers did not track the number of times students attended more than one SI session per week (students voluntarily attending SI could attend up to three sessions per week; students mandated into SI could attend only one SI session per week).

Establishing mandatory SI did have several drawbacks. The researchers were concerned if students in the mandatory SI freshman history section, attending 2 hours of class instruction, were learning the same amount of material as those in the other sections (receiving 3 hours of instruction). The instructor teaching the mandatory section had to restructure and condense her lectures to fit into 2 hours of instructional time each week instead of 3 hours. Students also had additional readings that were not covered in class, and SI leaders facilitated discussions on these readings.

Another drawback was that mandatory SI in this study was not cost effective for the campus learning center. The 10 SI leaders, hired for the mandatory section, conducted one SI session each week, which cost the same as hiring four traditional SI leaders holding SI sessions

three or four times each week. Luckily, the researchers had funds from an internal institutional grant to support the program. Finding 10 available rooms during peak class time was also a difficult task. Campus resources were limited and some of the rooms were less conducive to facilitate discussion or had to be scheduled in less accessible areas on campus.

Conclusions and Recommendations

This study supports previous research that students who voluntarily participate in SI benefit academically by earning higher grades and semester GPAs than students who choose not to participate. The study also provides new evidence to the field that students mandated into SI also benefit by earning significantly higher course grades in SI-supported courses and higher semester GPAs than nonparticipants. Another finding was that not all students, particularly males, perceive the need for academic support.

From these results the researchers posit that when students are exposed to effective learning opportunities (i.e., spending time on task, processing and reflecting on the lecture material, asking questions without fear of the instructor's evaluation, and implementing appropriate learning strategies), academic success occurs. Often instructors simply lecture but rarely help students make the connection between teaching and learning; SI may help students make that connection.

The results also support educators requiring students to participate in SI as effective academic intervention. However, mandatory SI is expensive and may require extensive revision of course content to accommodate SI as part of the course. One recommendation to remedy these two concerns is offered. Mandatory SI sessions could be a required, non-credit, laboratory experience for high-risk courses. The laboratory, scheduled once a week, could assess a small laboratory fee to provide revenue to pay the SI leaders. Course instructors would still participate in mentoring the SI leaders, but no change in the structure of the course would be needed. Another recommendation, based on prior success at UMKC, is to schedule one SI session weekly that fits the schedule for students who have been assessed as academically underprepared. Academic advisors would not schedule other classes at this time for these students.

Additional research is needed to replicate the findings of this study on the mandatory, voluntary and non-SI participation of students. Another area of interest is to investigate if men perceive less need for academic support than women.

Mandating students into academic support programs does seem to

return to a more *in loco parentis* environment for postsecondary institutions. However, to meet the needs of college students in the 21st century, educators might want to look to their past to seek new solutions for their future. Requiring students to attend academic support programs, such as SI, may be one of those solutions.

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