Comparison of Supplemental Instruction Strategies and Results for On-Campus and Distance Education Students

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Abstract

Supplementary Instruction (SI) is a proven tool to help undergraduate students succeed in traditionally difficult academic courses. SI involves scheduled group study sessions with direct peer-to-peer interaction between students and the SI leader. The SI strategy has proven its efficacy throughout a wide range of U.S universities that have embraced such a program. SI is offered at the University of North Carolina at Charlotte (UNC Charlotte) for several courses in a variety of programs, including the Electrical Engineering Technology (ELET) program. Since the ELET program also offers an IADE (Individual Access Distance Education) option for degree completion, online sections for on-campus courses are required. It is therefore necessary to have SI sessions available for the on-campus students as well as eSI (electronic SI) sessions for the IADE students.

For most ELET courses, WebCT is utilized as an asynchronous means of interaction between the instructor and students for both on-campus and IADE sections. The difference in interaction arises in the way supplemental instruction is designed and conducted, especially for the online courses, where traditional group study SI sessions are impossible. This limitation of the IADE offering necessitated the use of an alternate tool to provide IADE students the opportunity for synchronous interaction with the SI leader. CentraOne, an open architecture Web platform for knowledge delivery, is used in eSI to provide the desired peer-to-peer sessions and allow IADE students to directly interact with the SI leader. The recording and publishing capabilities of CentraOne are also used to provide unlimited asynchronous access of sessions to students in all sections.

A discussion of the difference between conducting conventional SI sessions and eSI sessions for the *Active Networks I* offering in the ELET program is the emphasis of this paper. In addition, the efficacy and the advantages of both SI and eSI will be discussed and analyzed through the qualitative and quantitative experiences of a SI leader in the ET department who conducted such sessions for technical courses.

Introduction

The Engineering Technology program at the University of North Carolina at Charlotte (UNC Charlotte) was originally designed as a 2+2 program, which means that students complete their first two years at a community college. After receiving an Associate in Applied Sciences (AAS) degree in a relevant field, they complete their upper division requirements at UNC Charlotte and

receive a Bachelor of Science in Engineering Technology (BSET) degree[1]. Traditionally, most students go to work after graduating with an Associate degree, and later decide to enhance their career opportunities by pursuing their BSET degree, either as part time or as full time. It has been observed that one of the main disadvantages of following this path is that many students have forgotten most of the basic concepts learned in their AAS program. It is then of paramount importance that students entering the ET department have enough discipline to review those concepts, as well as having additional resources available to assist them in acquiring the academic skills required of upper division courses.

Many of the difficulties that Engineering Technology students face in technical courses may be reduced or overcome by utilizing different kinds of learning resources. One of these resources is Supplemental Instruction (SI), a strategy which involves scheduled group study sessions with direct peer-to-peer interaction between students and the SI leader, who is also a student that had previously received an 'A' in the course[2]. The ET Department at UNC Charlotte offers SI for courses that are known to be difficult for most students. Since the ET program also offers an IADE (Individual Access Distance Education) option for degree completion, online sections of on-campus courses are required. It is therefore necessary to have traditional SI sessions available for the on-campus students, as well as eSI sessions for the IADE students.

SI was developed in 1973 by Dr. Deanna Martin at the University of Missouri at Kansas City[2, 3]. The purpose of this learning tool is to assist students in academic courses that traditionally have high DFW rates[1]. This was clearly observed in the *Active Networks I* course offered for the Electrical ET program (both on-campus and IADE). This junior level course is extremely calculation intensive; involving the modeling of microelectronics devices based on physical and operational properties, and the use of these models in design and analysis of circuits and systems based on these devices. In addition, this course, and its follow-on, requires extensive use of simulation software to analyze and optimize microelectronic circuits[4]. SI and eSI are offered for both on-campus and IADE sections of this course to help students succeed and understand the material, which is of fundamental importance in the profession and is considered as prerequisite for several senior-level courses.

Even though SI and eSI have the same goal, by necessity they differ in the way they are designed and conducted. SI involves traditional group study sessions with direct peer-to-peer interaction between the students and the SI leader, who also attends regular on-campus class hours with the students. Conversely, the IADE offering has no regularly scheduled class time and eSI requires using the CentraOne software as a Web platform for synchronous interaction between the IADE students and the SI leader through scheduled online sessions[5]. The remainder of this discussion provides an illustration and analysis of the techniques used in these sessions and their corresponding outcomes for the Fall 2003 semester.

On-Campus Section

The material covered in class for the on-campus section was also available for students online through WebCT[4, 6]. The presentation mechanism available in WebCT and utilized in this course included[*]:

[*] On-campus students had access to WebCT material developed for the IADE offering.

- ***Course Syllabus***: A detailed course description involving requirements, outcomes and success criteria for the course.
- ***Course Schedule***: Comprehensive information of the material covered by week and links to individual homework assignments.
- ***Course Content***: Lecture notes for all material covered in the course, examples, and online quizzes.
- ***PSpice Resources***: Active links to tutorials and information concerning the PSpice circuit simulation software.
- ***Email and Discussion Board***: WebCT tools for asynchronous communication between the instructor, SI leader and students.
- ***Homework and Test Solutions***: A compilation of homework and test solutions (automatically posted after their due date), in addition to sample tests and their solutions.
- ***Personal Space***: Used by each student to submit his/her homework and final design project. Access to a student's personal space is restricted to the individual student, the course instructor and the SI leader.
- ***Calendar***: Complete information of course requirements and announcements in a calendar format.
- ***Grades***: Showing homework, quiz and test grades for each student. Access to a student's grades is restricted to the individual student, the course instructor and the SI leader.

Three SI sessions per week were scheduled for the on-campus section to assist students encountering difficulties with course material and the manipulation of their accounts in WebCT. Based on the schedule of each student in the class, it was made sure that these three sessions were scheduled in a way that each student was able to attend at least one of these sessions.

Since *Active Networks I* is a technical course, it was obvious that the main activity in the SI sessions would be problem solving, and especially assistance with homework problems. It is a fundamental responsibility of the SI leader to motivate the students to think of the solution, or an approach to reaching the solution, rather than solving the problem for them. It was observed that the main difficulties faced by the students included, but were not limited to:

- The lack of knowledge of some basic concepts learned in introductory courses in circuit analysis. As mentioned earlier, this was mainly due to the elapsed time between learning the material at the community college and entering the BSET program.
- Misunderstanding points during the in-class lectures, and not having the discipline to review the material available on WebCT for clarification or asking the instructor for further explanation.
- Misinterpretation of information given in an assignment, or not recognizing required data and unknowns needed to solve the problem.
- Unfamiliarity with the PSpice simulation software.

The SI leader assists students to develop an approach to the solution depending on the kind of obstacle encountered in a given problem. Some of the ideal approaches used by the SI leader consist of:

- Put students in groups and have them discuss the problem together.

- Have one of the students solve the problem on the board with the assistance and collaboration of the entire group.
- Explain and clarify certain points that seem to be misunderstood from class lecture.
- Have the students look over their class notes to find the answer (The SI leader attended class with the students and has the same notes they have).
- Help students get started on the solution by solving on the board the first portion of the problem.
- Bring a laptop to the session to demonstrate the PSpice simulation of a given homework problem.

In addition to regular problem solving in these sessions, the SI leader would develop a study guide prior to each test in the course. The study guide would include a general overview of the main points covered in the course (naming the chapter's sections to be studied, main properties of different electronic devices, formula, etc) and also step-by-step procedures for solving specific kinds of problems. Students were motivated to make their own study guide and fill its gaps using that developed by the SI leader, but it was noticed that only few of the students used this studying strategy.

Over the course of the semester, it was found that each session had a distinct mood, depending on the students attending and the kinds of questions asked. At the beginning of the semester, the majority of the students attended the SI sessions with the attitude that they just wanted to get answers to their homework questions without making personal effort in any thinking process. The SI leader continually emphasized the fact that SI sessions are intended to help students understand the course material by thinking for themselves so they may learn an effective way of studying that could be applied to any technical course. Such a strategy worked in motivating some students to make extra effort while working on their homework even before showing up for the sessions.

Distance Education Section

Dealing with the distance education students was found to be a totally a different experience than that of the on-campus section. Students in the IADE program tended to be more disciplined, self-motivated and more serious about meeting deadlines and satisfying course requirements and expectations. The IADE students in *Active Networks* did not have as many problems with basic concepts and using reference materials provided when compared to the on-campus students. The SI leader was dealing with more mature and determined individuals who consider college education seriously since, in addition to their studies, most have full-time employment and significant family obligations. The main interest of these students was to gain as much knowledge as possible rather than simply being concerned about getting an 'A' in the course. Course material was delivered to these students through WebCT as outlined in the previous section[4].

In addition to the asynchronous communication through email and the discussion board in WebCT, CentraOne software was used to conduct eSI sessions and provide a synchronous method of interaction between the students and the professor/SI leader[4]. The Centra sessions were also recorded to allow for playback at the students' convenience. Three eSI/problem

sessions were scheduled per week, one in the morning (led by the course instructor) and two, at different time slots, in the afternoon (led by the SI leader). The afternoon sessions were rescheduled to evening to accommodate the students who had full-time employment during the day. As with the on-campus SI sessions, the purpose of the eSI sessions was to answer questions presented by the students concerning course material and homework assignments, as well as developing study and learning strategies.

Figure 1 represents a screen capture of a playback of a typical eSI session conducted by the SI leader and having one student as participant. As observed in the figure, the SI leader used a whiteboard, available in CentraOne, with the student to discuss a given problem. Such an interactive process was achieved through live voice and data sharing between the two parties. If desired, control may be given to the student(s) attending to allow them to actively participate in problem solution.

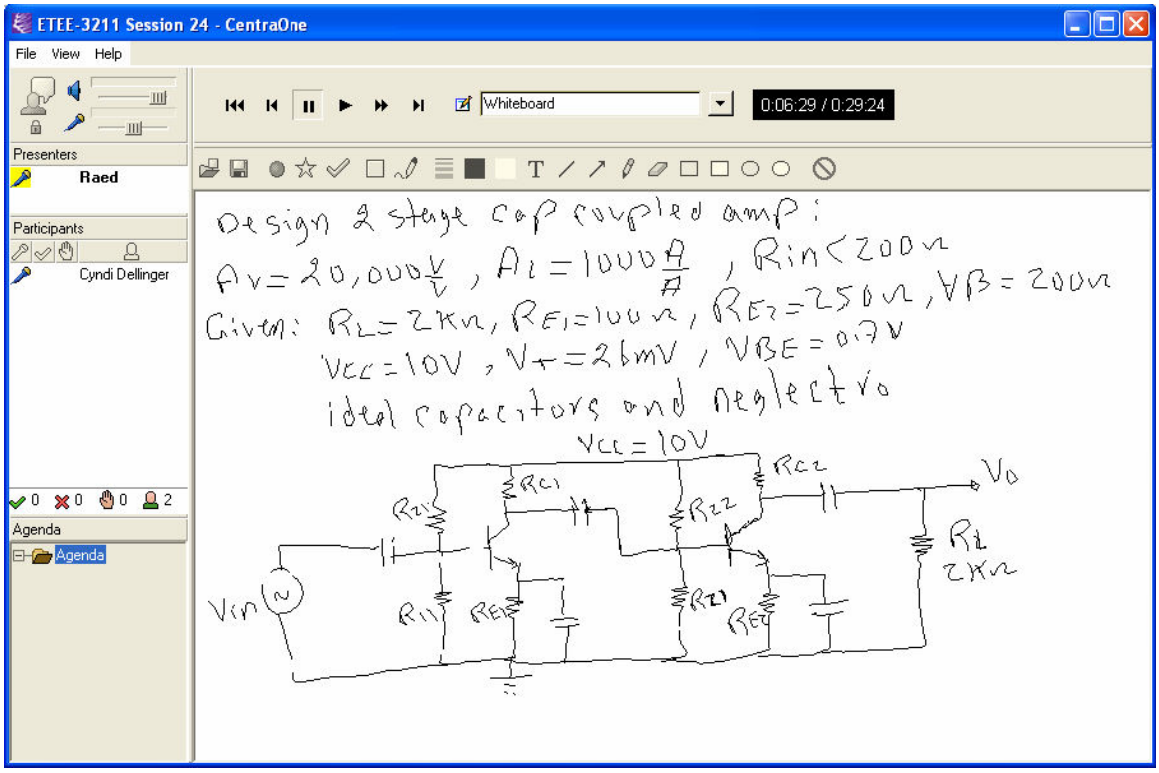

Figure 1: Screen Capture of a CentraOne Session

The kinds of questions and problems facing the IADE students were similar to those discussed earlier in the on-campus section, except that the IADE students only had their textbook, the course material provided to them through WebCT as the asynchronous means of communication discussed earlier. Since these students did not have the opportunity for in-class interaction and convenient access to the instructor and SI leader, the SI leader had to use a more direct approach in answering most of the questions.

Some of the approaches that the SI leader used to answer questions and solve problems during the eSI sessions included:

- Directly answer a presented question or explain unclear points.
- Provide some information from the lecture notes obtained from class, which might be more direct and specific than the online information.
- Start solving a given homework problem and stop based on positive feedback from the participants.
- Solve an example, from his/her notes, that was solved in class.
- Share PSpice simulation examples with the participants using the "Application Share" tool available in CentraOne.

If no student attended an eSI session, the SI leader used the session to review what was discussed in class and present any examples that the professor solved in class. In addition, similar to the on-campus SI sessions, tutorials were recorded for review before each test with sufficient lead-time so students had the opportunity to ask questions or present concerns before the scheduled test. This method proved to be helpful and practical based on positive feedback from the IADE students.

Results

The tables shown in Figure 2 below represent a summary of the rate of student's attendance in the SI and eSI sessions with respect to the average grade (on a 4.00 scale) and the DFW rates in each course section.

ETEE3211 Active Networks I (On-Campus)				
Total Number in class		34		
	Sessions Attendance			
	None	1 or 2	3 or 4	5 or more
Number of Students	3	10	2	19
% of Total	8.82	29.41	5.88	55.88
Average Grade	3.67	3.2	3	3.58
# of Withdrawals	0	0	0	0
D or F Grade	0	1	0	0

ETEE3211 Active Networks I (IADE)				
Total Number in class		8		
	Sessions Attendance			
	None	1 or 2	3 or 4	5 or more
Number of Students	6	1	0	1
% of Total	75.00	12.50	0.00	12.50
Average Grade	3.20	4.00	0.00	4.00
# of Withdrawals	1	0	0	0
D or F Grade	1	0	0	0

Figure 2: SI/eSI Results for On-Campus and IADE Sections – Fall 2003

As shown in the on-campus section results, over 50% of the students in the course attended more than five sessions during the semester, and obtained a final average that was higher than for those who attended less than five sessions. Only three students in the on-campus class did not attend any of the SI sessions. It is worthy of note that the three individuals who did not attend any SI sessions were mature individuals with full-time employment who had significant experience in one or more areas of course study.

In the IADE section, only one student attended eSI sessions regularly and one student attended a couple of times. The grade averages of both these students were the top averages in the class. Note that, although the IADE table indicates that six of eight students did not attend any eSI sessions, response to an informal end-of-semester course survey indicated that the majority of students who did not withdraw regularly reviewed the Centra recordings. The final averages of students that did not receive a 'D' or 'F' were all higher than their on-campus counterparts.

Conclusions and Future Work

The learning strategy that was discussed earlier, and that was used in the SI and eSI sessions whenever possible, represented an ideal strategy that should be applied in any SI environment. However, practically, these learning techniques cannot be followed exactly as described in every session because of the different character or mood of each session, which in turn is dependent on the students attending, the material being covered, and the problems presented.

Students of different academic backgrounds and knowledge levels were often present in the same session. Many times it was advantageous to form groups with mixed levels of expertise, however it was noticed that always putting students in one group to work all together on the same problem caused discomfort and frustration. When appropriate, the SI leader avoided this situation by making sure to group students of similar knowledge level together, so that the session's limited time was used efficiently for everybody.

Creating a "problem of the day" and solving it during the SI session may be more beneficial for the students than simply concentrating on homework problems. Using this strategy, the SI leader would provide the students with extra practice examples and only answer specific questions about the homework in the last portion of the session.

It was also observed that the study guides developed by the SI leader prior to each test did not benefit all students. It was found that before the second test, some on-campus students did not make any effort to study, instead relying on the fact that it would be enough to go through the review given by the SI leader and ended up doing poorly on the test. Even though every attempt was made to motivate students to create an individual learning technique through study guides or any other means, some of them did not take advantage of following such processes.

As mentioned earlier, most IADE students in the Fall 2003 ETEE3211 course did not take advantage of the "live" eSI sessions. In an informal end-of-semester survey, although most students reported reviewing available Centra recordings, they reported that the lack of attendance was either because they didn't feel the need for any help in course material or because the eSI times were not convenient. If possible, it would therefore be advantageous to consult students before the semester begins to agree on a convenient time that works for the majority[*]. In addition, more information about eSI, its strategies and advantages will be provided to the students through orientation, WebCT and email. This should help insure that students will fully understand how eSI can benefit them and how to obtain maximum advantage through session attendance.

Additional value of SI/eSI sessions may be achieved through further emphasis and exercises in the area of self-motivation and group work. As students progress through their academic career and in their future professional life, being part of a team is a skill critical for success. Incorporating teamwork and productivity requirements in the basic SI/eSI sessions would provide another opportunity to develop and enhance these skills.

[*] Currently, the day(s) and time(s) of eSI sessions are set up well before the beginning of the semester.

References

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