Implementation of Supplemental Instruction for Physical Therapist Students in an Exercise Physiology Course

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ABSTRACT

An ongoing challenge for faculty is to determine effective and efficient mechanisms for assisting students to achieve academic success. Supplemental Instruction (SI), a form of peer tutoring, has been defined as a peer-led academic assistance program that targets difficult courses and is offered to students enrolled in those courses. Based on student feedback that exercise physiology is difficult, the authors chose this course in the Doctor of Physical Therapy (DPT) curriculum for this post-only pilot study. SI was offered over a three-year period to physical therapist students enrolled in an exercise physiology course. The purposes of this study were to 1) determine the perceived benefits of SI by students who attended at least one session, 2) identify reasons students never attended SI or started attending SI and then stopped, 3) identify the degree of student satisfaction with SI, and 4) identify students' willingness to recommend SI for exercise physiology or other DPT courses. An 18-item written questionnaire was the assessment method. A total of 203 students participated over the three-year period. Frequency distributions and percentages were calculated for each of the multiple choice questionnaire items to determine results of students' perceptions of SI. Students' perceived benefits included 1) improved academic performance, 2) improved confidence, 3) increased contact with other students, 4) improved understanding of the material, 5) improved motivation to learn, and 6) improved understanding of instructor expectations. Frequently cited reasons for never attending were conflicts with other courses and/or work schedule, and not perceiving the service as needed. Students cited lack of time to attend sessions and alternative study methods as frequent reasons for attending SI and then stopping. In each of the three years, at least 85% of the students who attended at least one SI session were satisfied. The percentage of students who would recommend SI for exercise physiology or other DPT courses was consistently ≥ 70%. Given the positive outcomes of this three-year implementation of SI in an entry-level physical therapy curriculum, other colleges and universities may wish to consider implementation of an SI program for health professions' courses.

INTRODUCTION AND BACKGROUND

An ongoing challenge for faculty in professional programs is to determine effective and efficient mechanisms to assist student academic achievement.[1] Opportunities for faculty to meet with individual students and small groups of students outside the classroom may be difficult due to the increasing demands for faculty scholarship, clinical practice, and/or service.[2,3] One approach described in the literature to improve students' academic achievement while not increasing demands on faculty is supplemental instruction (SI), a form of peer tutoring.

Peer tutoring is defined in the literature as a learning strategy in which people from similar social groupings who are not professional teachers help each other to learn and enhance their own learning by teaching.[4] Peer tutoring focuses on students who desire additional assistance with course material outside the classroom and is organized in a one-to-one or small group format. Peer tutors are trained to model effective approaches to learning and to facilitate discussion of course content.[4] According to Topping, peer tutoring increases course satisfaction and understanding of course concepts while improving academic performance.[4] Students perceive that peer tutors provide insight into course content and demands of the instructor because peer tutors recently experienced the course.[5] In their review of peer tutoring programs in health professional schools, Santee, et al found that tutored students may feel more comfortable asking questions of peer tutors rather than faculty and may understand the content more clearly because it is explained in different terms by the tutors.[6] Peer tutoring offers an alternative way of learning that can meet the perceived or real needs of the student and is consistent with Vygotsky's social constructivist theory.[5,7] Vygotsky discussed differences between learners' independent accomplishments and learners' accomplishments in collaboration with experienced peers.[7] "The experienced learner can provide support, or scaffolding, for the new learner, thereby boosting the new learner's abilities to the level of the experienced learner. What learners are able to do in collaboration today, they will be able to do independently in the future."[8]

Lake studied the use of group peer tutoring in a five-year physical therapist bachelor's program. The benefits of optional weekly group tutoring sessions offered to third year physical therapist students enrolled in gross anatomy and advanced physiology were described.[1,9] Sessions were coordinated by fifth-year students who had previously completed the courses. Students perceived the group peer tutoring sessions for gross anatomy and advanced physiology as highly valuable and recommended the continuation of group peer tutoring sessions for future courses.[1,9] While Lake described this process as group peer tutoring, it is similar to the definition of SI.

SI evolved from peer tutoring and is defined as a peer-led academic assistance program that targets traditionally difficult courses and is offered to all students enrolled in those courses.[8] The goal of SI is to reduce dropout rate and usually is targeted at high risk courses that contain new and challenging content rather than high risk students.[4,10] SI is voluntary and traditionally begins in the first weeks of class before tests have been administered. Offering SI prior to the first test stresses a collaborative learning experience rather than remediation. During SI sessions, students are engaged in active learning by asking questions, participating in discussion, and applying course material.[11] Hurley, et al. found that first year medical students in an integrated study of disease course were satisfied with the quality of SI and recommended SI to future students despite the fact that SI attendance decreased as the semester continued.[12] Students enrolled in a psychology course who regularly attended SI had higher self esteem, greater self efficacy, and greater internal locus of control.[13] Evidence has shown that SI is a helpful educational tool in undergraduate arts and science and health professional courses.[6]

Historically, Saint Louis University did not offer academic tutoring for professional courses in the Doisy College of Health Sciences. Therefore, the faculty member who served as the Chair of the Student Affairs Committee in the Program in Physical Therapy and had a PhD in Higher Education volunteered to serve as Program Tutor Coordinator. This was in addition to existing faculty responsibilities. The Program Tutor Coordinator developed and supervised a program of one-to-one peer tutoring for students who needed assistance in Doctor of Physical Therapy courses. However, requests for one-to-one peer tutors exceeded the number available. Given the support for SI in the literature, the Program Tutor Coordinator developed SI as an addition to our one-to-one peer tutoring program.

Implementation of Supplemental Instruction

The authors and one-to-one peer tutors recommended SI for exercise physiology, a course offered in the third year of a six-year freshman entry-level physical therapy curriculum. This is the first professional course students take and is perceived by the students to be difficult as expressed in student course reviews. In contrast to the basic human physiology course taken previously, the course progresses from a cellular level to a systems level of complexity and contains new and challenging content that emphasizes application over recall of knowledge. For example, this course covers exercise testing and analysis, exercise prescription, measurement of body fat, as well as strength, power and endurance training. Students are required to pass a comprehensive final exam and cannot advance into other professional courses without passing this course. Since the

number of physical therapist students in the class typically ranges from 70 to 85 and no teaching or lab assistants are available, a secondary intent of offering SI was to reduce the demands on course coordinator time for individual student meetings to clarify exercise physiology course material.

Program Tutor Coordinator and Course Coordinator Roles and Responsibilities
The Program Tutor Coordinator supervised the SI program. This individual sought and obtained approval and financial remuneration for SI tutors from the Dean of the Doisy College of Health Sciences for a one-year trial period. Financial support was extended subsequently for two additional years based on positive assessment outcomes of the first year.

The exercise physiology Course Coordinator and the Program Tutor Coordinator met prior to the start of the course in each of the three years to identify optimal weeks during the semester to conduct SI sessions. Students had the opportunity to attend at least one SI session prior to each exam. The number of SI sessions offered per year varied due to SI tutor availability and scheduled breaks in the academic year which resulted in the following number of SI sessions: 11 (2007), 7 (2008), and 13 (2009). Sessions were scheduled for 90-minutes which was consistent with guidelines described by Hurley, et al.[12]

The Program Tutor Coordinator scheduled locations convenient to students and recruited SI tutors from the group of physical therapist students already participating as one-to-one peer tutors. An attempt was made to schedule two or three SI tutors per session, but at times, only one SI tutor was available. The Program Tutor Coordinator instructed the SI tutors regarding the SI format. The Program Tutor Coordinator attended an early exercise physiology class session to orient the students to the purpose of and format for SI sessions and to distribute a schedule of SI sessions. Students were told SI sessions were offered free of charge, open to all regardless of GPA, and conducted by SI student tutors who had performed well previously in the class. Students were informed that attendance was voluntary, and the Course Coordinator would not have knowledge of who attended SI sessions. The Course Coordinator posted the SI schedule on the course web page. Questions that could not be answered by the SI tutors were emailed to the Course Coordinator who answered the questions during the following class.

SI Participants' Roles and Responsibilities
In the first two years, students were encouraged to post a question on the course web page prior to attending an SI session. SI tutors reported that students rarely posted questions on the web page and frequently were unprepared for the SI sessions. Therefore, in the third year of SI, students were required to submit a question on the course web page prior to the SI session or present a written question to the SI tutor at the door. SI tutors who taught in the second and third years of the program reported this change in procedure enhanced discussion between the SI tutors and the students. In addition to SI sessions, students had the opportunity to seek other forms of academic assistance including, but not limited to, one-to-one peer tutoring and/or meeting with the Course Coordinator.

SI Tutors' Roles and Responsibilities
Criteria for participation as an SI tutor were 1) completion of the exercise physiology course 1-2 years prior, 2) achievement of a B (84%) grade or above in the exercise physiology course as required by University tutoring policy, and 3) participation in training through the University as a one-to-one tutor. SI tutors received financial remuneration for their services and had the option to resign at any time. Each SI tutor signed a confidentiality agreement.

The exercise physiology course web page and syllabus were available to the SI tutors. Responsibilities of the SI tutors were to take attendance, discuss basic course concepts, and answer student questions. SI sessions were designed to encourage open-ended discussions regarding course material. SI tutors addressed the level of complexity of the material as well as how to synthesize course information. Material discussed during SI sessions was not posted on the course web page in order to encourage SI attendance. Attendance allowed student-to-student interaction and provided exposure to the SI tutors' approaches to the material. If a student brought a written question to the SI tutor at the door, one SI tutor would prepare a response while the other SI tutor(s) conducted the session. Questions presented at the door presented difficulties when only one SI tutor was present. Questions that could not be answered by the SI tutors were referred to the Course Coordinator who subsequently reviewed the concepts in class.

METHODS
In order to determine the perceived efficacy of SI, the authors designed a post-only study to gather feedback enrolled in exercise physiology. The purposes of this study were to 1) determine the perceived benefits of SI by students who attended at least one session, 2) identify reasons students never attended SI or started attending SI and then stopped, 3) identify the degree of student satisfaction with SI, and 4) identify students' willingness to recommend SI for exercise physiology or other Doctor of Physical Therapy courses.

At the end of the first year, the authors developed and administered a questionnaire to the students enrolled in exercise physiology to assess the usefulness of SI and to justify ongoing funding. The questionnaire addressed each of the four purposes of the study. Subsequently, the questionnaire was administered in years two and three (Table 1). The number of students who completed the questionnaire in each of the three years ranged from 57 to 77.

The authors obtained approval from the IRB at Saint Louis University to administer the questionnaire and disseminate the results. The questionnaire was administered in paper format within one month of the conclusion of the course in each of the three years. Completion of the questionnaire was voluntary, and responses were anonymous. Students were instructed to submit their questionnaires, completed or not completed, into a sealed container. Submission of a completed questionnaire indicated consent to participate. No identifiers were included that would link a student to a particular questionnaire. The Course Coordinator was not present during administration of the questionnaire.

The questionnaire included 18 items. First, students were asked if they had attended at least one SI session. Students who had attended at least one SI session were routed to a series of questions regarding perceived benefits of SI. Responses were based on a 4-point Likert scale (Strongly Agree, Agree, Disagree, Strongly Disagree). Students also were given the opportunity to write in a benefit not listed. These same students were asked to respond to a question related to their satisfaction with the SI experience. Responses were based on a 4-point Likert scale (Very Satisfied, Satisfied, Somewhat Satisfied, Not Satisfied). Students who did not attend SI sessions were asked to choose from a list of possible reasons why they did not attend. Students also were given the opportunity to write in reasons not listed. Likewise, students who started and then stopped attending SI sessions were asked to indicate from a list of possible reasons why they stopped attending. Students could provide reasons that were not listed. All students were asked (Yes, No, No Opinion) if they would recommend SI sessions for exercise physiology in the future and if they would be willing to attend SI sessions for future Doctor of Physical Therapy courses.

DATA ANALYSIS AND RESULTS
Frequency distributions and percentages were calculated for each of the multiple choice questionnaire items (SPSS Version 13.0). Written comments to open-ended questions were reviewed by the authors.

Table 1 contains the number of physical therapist students who 1) were enrolled in exercise physiology in the spring of 2007, 2008, or 2009, 2) completed a questionnaire, 3) attended at least one SI session, and 4) did not attend any SI sessions. Because attendance was voluntary, the number of students present varied. The average number of students who attended individual SI sessions per year was 4.6 in 2007, 10.4 in 2008, and 10.5 in 2009. No student attended all sessions in any of the years.

Table 1. Physical Therapist Student Enrollment and Questionnaire Completion

	2007 N (%)		2008 N (%)		2009 N (%)
Total Number of Students Enrolled	82		76		73
Completed Questionnaire	77 (93.9)		69 (90.7)		57 (78.0)
• Attended at least one SI session	51 (61.2)		33 (47.8)		35 (61.4)
• Did not attend any SI sessions	26 (33.8)		36 (52.2)		22 (38.6)

Perceived Benefits
One purpose of the questionnaire was to seek feedback regarding the students' perceived benefits of SI. Students who responded to these questions had to have attended at least one SI session. The categories of "Strongly Agree" and "Agree" were collapsed into one category; "Disagree" and "Strongly Disagree" were collapsed into a second category. In each of the three years, greater than 70% of the students who attended SI agreed with several of the benefits listed on the questionnaire (Table 2): 1) improved academic performance, 2) improved confidence, 3) increased contact with other students in their class, 4) improved understanding of the material, 5) improved motivation to learn, and 6) improved understanding of instructor expectations. SI offered at no cost was perceived as valuable by all students who attended at least one session. One student wrote that a benefit not included on the questionnaire was "more opportunities to learn through different explanations." Another student wrote that SI sessions "raised questions that I did not know I had." The students' chosen responses to listed benefits and their written comments support SI as a means by which students are empowered to take ownership of their learning through the leadership of peer tutors in a non-threatening collaborative learning environment.

Table 2. Perceived Benefits of Attending SI**

	2007			2008			2009	
	SA/A* N (%)	D/SD* N (%)		SA/A* N (%)	D/SD* N (%)		SA/A* N (%)	D/SD* N (%)
Improved academic performance	46 (90.2)	5 (9.8)		23 (74.2)	8 (25.8)		32 (94.1)	2 (5.9)
Improved confidence	45 (88.2)	6 (11.8)		27 (84.4)	5 (15.6)		33 (97.1)	1 (2.9)
Increased contact with other students	38 (74.5)	13 (25.5)		25 (78.1)	7 (21.9)		25 (73.5)	9 (26.5)
Improved material understanding	49 (96.1)	2 (3.9)		25 (78.2)	7 (21.9)		33 (94.3)	2 (5.7)
Improved motivation to learn	44 (88.0)	6 (12)		23 (71.9)	9 (28.1)		27 (79.4)	7 (20.6)
Improved understanding of expectations	48 (94.2)	3 (5.9)		26 (80.6)	6 (18.8)		33 (97)	1 (2.9)
Provided without cost	47 (100)	0 (0)		32 (100)	0 (0)		33 (100)	0 (0)

*SA= Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree
** Respondents attended at least one SI session. Some items were not answered by all respondents. The percentages reflect the total number responding to each item, not the total number responding to the questionnaire in a given year.

Reasons for Not Attending SI

Table 3 presents the reasons students chose for not attending SI. Although the responses were inconsistent across years, the most frequently identified reasons were conflict with other courses, conflict with work schedule, and the perception that SI was not needed. While efforts were made to schedule SI sessions at convenient times, conflicts were unavoidable. A common written reason for not attending SI sessions was student choice of another method of academic assistance.

Table 3. Reasons for Never Attending SI*

	2007 N (%)		2008 N (%)		2009 N (%)
Conflict with other courses	11 (42.3)		6 (16.7)		8 (36.4)
Conflict with work schedule	10 (38.5)		10 (27.8)		11 (50.0)
Conflict with social activities	2 (7.7)		1 (2.8)		2 (9.1)
Did not feel I needed this service	7 (26.9)		21 (58.3)		13 (59.1)
Other	4 (15.4)		7 (19.4)		2 (9.1)

*Some items were not answered by all participants attending at least one session. Respondents could choose more than one response.

Reasons for Stopping Attendance at SI

Table 4 presents the responses of those students who started attending SI sessions and then chose to stop. The most frequently identified reasons were that they could not spare the time or they found another study method. Common additional study methods used by students in the Program in Physical Therapy were informal group study, studying alone, one-to-one tutoring and Course Coordinator assistance. The perception that SI was not beneficial was chosen rarely. SI sessions were perceived as providing a comfortable learning environment. A common written reason for stopping attendance at SI sessions was scheduling conflicts.

Table 4. Reasons Students Started Attending SI and Then Stopped*

	2007 N (%)		2008 N (%)		2009 N (%)
I found another study method that was more beneficial to me.	13 (25.5)		8 (24.2)		4 (11.4)
I could not spare the time to attend the sessions.	11 (21.6)		5 (15.2)		9 (25.7)
I did not feel adequately prepared prior to the sessions.	4 (7.8)		6 (18.2)		5 (14.3)
I did not feel comfortable in this type of learning environment.	0 (0)		0 (0)		0 (0)
I did not feel that these sessions were beneficial.	6 (11.8)		7 (21.2)		1 (2.9)
Other	16 (31.4)		6 (18.2)		12 (34.3)
*Some items were not answered by all participants attending at least one session. Respondents could choose more than one response.					

Satisfaction with SI

Students were asked to rate their level of satisfaction with SI according to four categories ranging from "Very Satisfied" to "Not Satisfied". The categories of "Very Satisfied," "Satisfied," and "Somewhat Satisfied" were collapsed into one category. The percentages of students satisfied with how SI sessions improved their understanding of course material were 98.1% in 2007, 84.8% in 2008 and 97.1% in 2009. Possible reasons that a high percentage of students who attended SI were satisfied were that the tutors were trained in the one-to-one tutoring program and thus were experienced tutors, and the SI program was a new academic assistance program that was being offered for a course that was historically perceived by students as difficult. A possible explanation for a decrease in satisfaction in 2008 was that the tutors for the first SI session were not well prepared due to their own test schedules. This lack of preparation may have biased the students regarding the benefit of attending SI sessions for the remainder of the semester. In the third year, the Program Tutor Coordinator emphasized the importance of being prepared for SI sessions regardless of tutor exam schedules. The authors believe this was reflected in improved student satisfaction with SI in the third year.

Willingness to Attend Future SI

All students who completed the questionnaire were asked to indicate if they would recommend SI sessions for exercise physiology or for other Doctor of Physical Therapy courses. The percentages of students who recommended SI for the exercise physiology course in the future were 92.2% in 2007, 75.8% in 2008, and 70.2% in 2009. A possible reason for the decline in these percentages was an increased number of peer tutors available for one-to-one peer tutoring for exercise physiology. The percentages of students who would attend SI sessions for other Doctor of Physical Therapy courses were 92.2% in 2007, 87.5% in 2008, and 93% in 2009.

DISCUSSION AND LIMITATIONS

The authors recognize that the sample size of students who attended SI sessions was small in each of the three years of the study. However, the authors were interested in gathering feedback from those students who attended SI in order to determine if SI should be continued. In each of the three years that SI was offered, greater than 84% of the students who attended SI sessions reported some degree of satisfaction. Greater than 70% of the students who attended SI sessions identified several benefits: 1) improved academic performance, 2) improved confidence, 3) increased contact with other students, 4) improved understanding of the material, 5) improved motivation to learn, and 6) improved understanding of instructor expectations. Written student comments indicated that SI attendance revealed questions students had not previously considered and SI provided more opportunities to learn by acquisition of transferable study skills through peer role modeling. One hundred percent of the students who attended at least one session indicated that providing SI without cost was valuable.

The most frequently cited reasons for not attending SI were conflicts with other courses or work schedules. While efforts were made to schedule SI sessions at convenient times, conflicts were unavoidable. Additionally, some students did not feel they needed SI or they found another form of academic assistance. The most common reasons cited for stopping attendance at SI sessions were that students found another study method or could not spare the time to attend the sessions. The authors did not inquire about alternate study methods students used to enhance their success in the course.

SI was offered to all students, regardless of academic performance. At least one session was offered before the first examination with the hope that students would not perceive SI as remedial. However, the assessment did not include questions regarding student perceptions of SI sessions as remedial.

The actual effect of SI on academic performance was not objectively determined; however, a high percentage of the students perceived that SI improved their academic performance. The authors considered assessing the effect of SI on academic performance, but multiple variables that could have contributed to improved academic performance limited the ability to determine the impact of SI alone. Some of these variables included informal student study groups, formal one-to-one peer tutoring, and individual student meetings with the Course Coordinator. The Course Coordinator reported a decrease in the amount of time devoted to meeting with students to clarify course content in the three years that SI was offered for exercise physiology. However, the authors did not objectively track instructor/student meeting time prior to the initiation of SI and compare it to meeting time during the three-year assessment period.

An additional limitation of this pilot study included the lack of a control group. The authors had an ethical concern regarding withholding an educational opportunity that had been proven to be successful in the literature. A cross-over method was not chosen since exercise physiology was offered only once a year. Another limitation of this pilot study was that because of time constraints, the authors did not conduct usability or reliability studies on the questionnaire. SI was initiated to solve the immediate problem of a lack of one-to-one peer tutors, and the authors needed to gather data quickly to justify continued funding of SI for subsequent fiscal years.

CONCLUSIONS AND FUTURE STUDIES

Overall, the literature supports the use of group peer tutoring and SI instruction in health professions' courses. However further research is needed in this area such as assessing perceptions of SI by SI tutors or the course coordinators, objectively determining the effect of SI on academic performance, and tracking the amount of time spent by course coordinators in meeting with students to determine the effect of SI on faculty time. Another area of research could be a comparison of SI, SI plus one-to-one peer tutoring, one-to-one tutoring alone, and no formal academic assistance.

SI can be an effective mechanism to assist student academic achievement and serve as an effective adjunct to one-to-one peer tutoring. This three-year assessment of the students' perceived benefits of SI for exercise physiology is consistent with the literature regarding other health professions' courses. Physical therapist students enrolled in an exercise physiology course who attended at least one SI session perceived it as a beneficial method to assist in the comprehension of the course material. Students who participated recommended continued SI for exercise physiology and future Doctor of Physical Therapy courses. Other colleges and universities may wish to consider implementation of an SI program for health professions' courses.

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KEY TERMS

Supplemental instruction, Health professional education, Peer tutoring