

# *Pathways of Persistence: A Review of Postsecondary Peer Cooperative Learning Programs*

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*This chapter focuses upon a subset of the broader educational practice of peer collaborative learning, specifically postsecondary peer cooperative learning programs that embed study strategy practice within their activities. These practices have demonstrated higher student outcomes including increasing student persistence towards graduation. Adoption of such research-based practices has become more essential because institutions cannot waste scarce resources on programs that may not contribute both to increased student success as well as enhancing the institution's economic stability through lower student dropout rates and the loss of tuition dollars.*

**P**eer collaborative learning has been popular in education for decades. As both a pedagogy and a learning strategy, it has been frequently adopted and adapted for a wide range of academic content areas throughout education at the elementary, secondary, and postsecondary levels due to its benefits. The professional literature is filled with reports of individual professors integrating this approach into postsecondary classrooms in diverse ways. Increased attention has been placed on this practice due to claims by some programs that carefully coordinated and managed learning programs with specific protocols can increase student persistence rates toward graduation, supporting student aspirations as well as bolstering institutional revenues.

This chapter does not attempt to be inclusive of this broad field of literature concerning peer collaborative

learning. Instead, it is focused intentionally on a subset of the educational practice that shares a common focus with increasing student persistence toward graduation. Rather than a meta-analysis of all published research studies, this chapter is a preliminary review and a description of six models. At the end of the chapter several suggestions are made for differentiating the models from each other and the level of institutional resources required for implementing them.

The six student peer learning programs included in this chapter meet the following characteristics: (a) must have been implemented at the postsecondary or tertiary level, (b) has a clear set of systematic procedures for its implementation at an institution, (c) has been evaluated through studies that are available for review, (d) intentionally embeds learning strategy practice along

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with review of the academic content material, (e) includes outcomes of both increased content knowledge and higher persistence rates, and (f) has been replicated at another institution with similar positive student outcomes. From a review of the professional literature six programs emerged: Accelerated Learning Groups (ALGs), Emerging Scholars Program (ESP), Peer-Led Team Learning (PLTL), Structured Learning Assistance (SLA), Supplemental Instruction (SI), and Video-based Supplemental Instruction (VSI). As will be described in the following narrative, some of the programs share common history and seek to improve upon previous practices. Other programs were developed independently.

## Collaborative Learning, Cooperative Learning, and Learning Communities

A review of the professional literature finds that the terms collaborative learning, cooperative learning, and learning communities are sometimes used interchangeably. Although they share similarities with one another, a more precise differentiation is needed to help explore the utility of each for its intended educational outcomes (Cooper, Robinson, & Ball, 2003). Regarding their historical development and appearance within the professional literature in the United States, collaborative learning appeared first, cooperative learning second, and learning communities last. A search of the Educational Resources Information Center (ERIC) Database (2004) found more than 8,000 entries regarding descriptive and research studies that contained one or more of the three terms indexed within their documents.

Collaborative learning refers to a wide range of formal and informal activities that include any form of peer student interaction. This is the broadest and most general of the three terms. This term describes any classroom activity by an instructor that involves student peer-to-peer involvement. Cooperative learning is more narrowly defined as a subset of collaborative learning. It often follows these principles: (a) positive interdependence established in the group through adoption of different roles that support the group's moving to complete a goal, (b) peer interaction, (c) activities structured to establish individual accountability and personal responsibility, (d) development of interpersonal and small group skills, and (e) group processing of small group activities

through verification of information accuracy (Cuseo, 2002; Johnson, Johnson, Holubec, & Roy, 1984).

In contrast with collaborative and cooperative learning groups, learning communities are distinguished by their focus on interactive peer learning. Learning communities are often more focused on enhanced curricular and pedagogical outcomes. In addition to often employing some version of student interactive learning, learning communities take several approaches to modifying the classroom experience by restructuring the curriculum. Some of the ways that courses may be modified are through linked courses, learning clusters, freshman interest groups, federated learning communities, and coordinated studies (Gabelnick, MacGregor, Matthews, & Smith, 1990).

A way to understand the relationships among these three terms is through a diagram, as provided in Figure 1. Collaborative learning is considered to be the largest construct, both due to its general definition as well as its numerical ranking as most frequently cited in professional literature (ERIC, 2004). A smaller construct lies within collaborative learning. This is cooperative learning. Although it holds to the same generalizations and goals of collaborative learning, it is much more specific in its implementation and following of specified protocols for its use. A related concept to both collaborative and cooperative learning is that of learning communities. While learning communities often utilize some peer collaborative or cooperative learning activities as part of their pedagogy, they generally focus more on curricular transformation. However, it is possible to implement some aspects of learning communities without extensive use of either collaborative or cooperative learning because the focus may be more on team teaching by instructors and the integration of academic content material (e.g., a cluster course that merges the content of an introduction-to-science with an ethics course) rather than extensive use of student peer interactive learning activities.

In this chapter the focus will be on peer cooperative learning programs that embed learning strategies practice within review of the academic content material and that also meet the other selection criteria previously mentioned. This is an important topic in the field of developmental education and learning assistance in particular and for postsecondary education in general because of the need by institutions to meet the needs of



a more diverse entering student body while maintaining or increasing academic rigor (Bastedo & Gumpert, 2003). The institution must make systemic changes in the educational environment that will increase the academic success and persistence rates of all students to meet the expectations of stakeholders such as parents, legislators, and funding agencies. Although the number of academically underprepared students is increasing, historic delivery systems of academic development for students such as remedial and developmental courses are being reduced or eliminated by some states (Barefoot, 2003; Damashek, 1999; Parsad & Lewis, 2003). Many institutions have already adopted one or more of the six programs described in this chapter. The need for such approaches may increase due to the demands to meet the needs of access to an increasingly diverse student body without the traditional approaches offered by developmental education in the past.

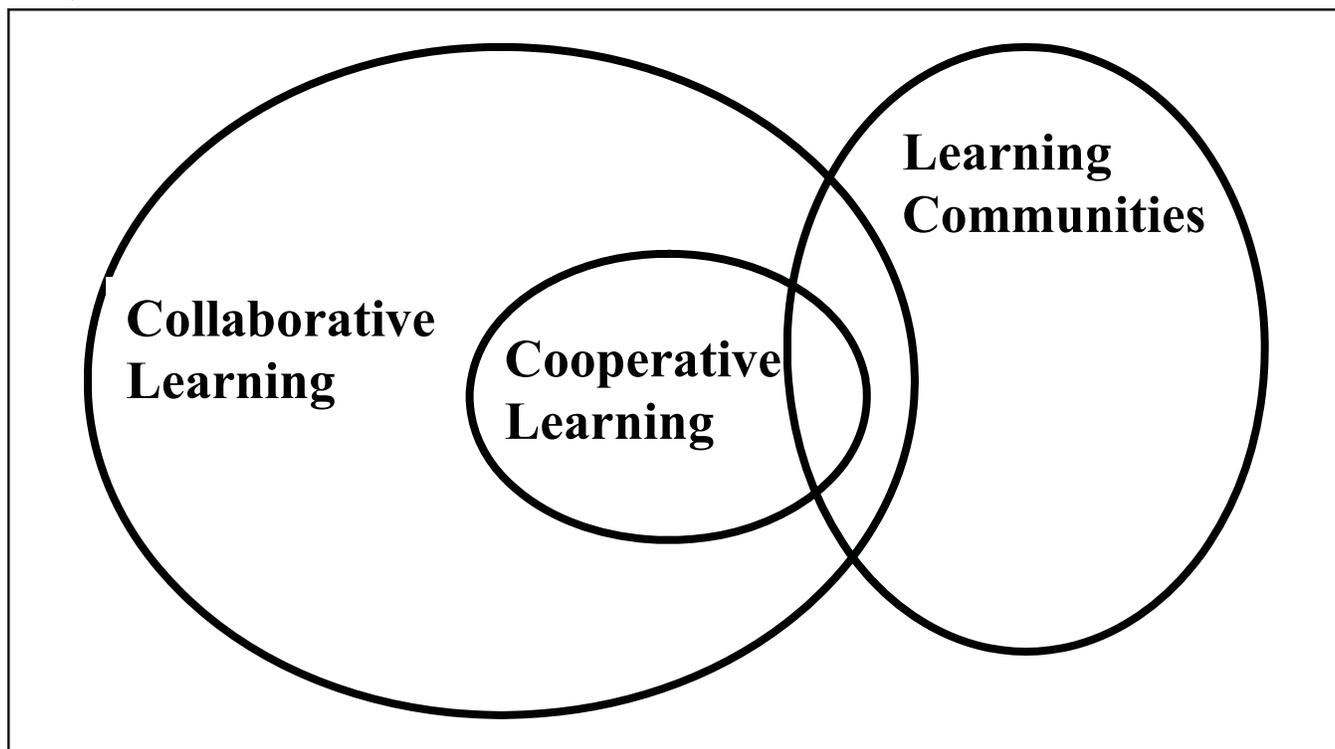
### Six Major Postsecondary Peer Cooperative Learning Programs

Six postsecondary peer collaborative learning programs were selected for inclusion in this chapter based on the criteria mentioned earlier in the narrative; the six are: (a) Accelerated Learning Groups (ALGs),

(b) Emerging Scholars Program (ESP), (c) Peer-Led Team Learning (PLTL), (d) Structured Learning Assistance (SLA), (e) Supplemental Instruction (SI), and (f) Video-based Supplemental Instruction (VSI). A short narrative overview of each follows with results from several research studies that have examined the impact upon student outcomes. The six programs have been divided into two groups.

The first group consists of those models that provide adjunct support through outside-of-class activities with little change by the primary course instructor. The first in this category is SI. In recent years two programs have been developed to address limitations of the SI model: ALGs and SLA. The second group of peer cooperative programs are those that share a common characteristic of a transformed classroom learning environment for all enrolled students. Major changes have been made by the primary course instructor through either integration of the peer learning model into the basic course delivery or heavy involvement by the instructor with the peer learning activities. The first of these programs is ESP, developed at approximately the same time as SI in the 1970s. In the 1990s two programs were created with similar purposes and protocols to ESP: PLTL and VSI. Most of these six programs cite in

Figure 1. Relationship Among Selected Learning Pedagogies.



their literature reviews references concerning the other peer learning programs as it appears that each have been an incremental improvement upon previous peer learning models.

### *Adjunct Peer Cooperative Learning Programs to the Course*

*Supplemental Instruction (SI).* The Supplemental Instruction model of academic assistance helps students in historically difficult classes master content while they develop and integrate learning and study strategies. The program was originally developed at the University of Missouri-Kansas City in 1973 and has been adopted by hundreds of institutions in the U.S. and abroad (Arendale, 2002). Goals of SI include: (a) improving student grades in targeted courses, (b) reducing the attrition rate within those courses, and (c) increasing graduation rates of students. All students in a targeted course are urged to attend SI sessions, and students with varying ability levels to participate. There is no stigma attached to SI because courses that have had high rates of Ds, Fs, and course withdrawals for multiple academic terms are the focus rather than attempting to identify specific students who are deemed to be high risk for failure due to predictors such as low standardized test scores or previous academic failures at the secondary or postsecondary levels. SI can be implemented in one or more courses each academic term (Martin & Arendale, 1994).

There are four key persons involved with SI. The first is the SI supervisor, a trained professional on the SI staff. The SI supervisor is responsible for identifying the targeted courses, gaining faculty support, selecting and training SI leaders, and monitoring and evaluating the program. When the historically difficult courses have been identified, the SI supervisor contacts the faculty members concerning SI for their course. The second key person for SI is the faculty member who teaches one of the identified courses. SI is only offered in courses in which the faculty member invites and supports SI. Faculty members screen SI leaders for content competency and approve selections. The third key person is the SI leader. SI leaders are students or learning center staff members who have been deemed course competent, approved by the course instructor, and trained in proactive learning and study strategies. SI leaders attend course lectures, take notes, read all assigned materials, and conduct three to five

out-of-class SI sessions per week. The SI leader is the “model student,” a facilitator who helps students to integrate course content with learning and study strategies. The fourth key component of the SI program is the participating students.

There have been several hundred research studies concerning SI conducted at institutions from around the world. Some of these and related information are available through Web sites maintained by the National Center for SI (Painter, 2004) and other professional organizations (Lipsky, 2004).

Doty (2003) reported on data supplied by 53 U.S. institutions between 1998 and 2003 concerning academic achievement for SI participants and nonparticipants. The data was drawn from SI reports covering 745 courses with a total enrollment of 61,868 students. SI participants were defined as those who attended one or more of the voluntary, out-of-class SI sessions sometime during the academic term. Outcomes displayed in the report included that SI participants received a D, F, or withdrew from the course at a rate between one-third and one-fourth that of nonparticipants, regardless of institutional type. In addition, mean final course grades were approximately a half letter grade higher for SI participants. These differences were statistically significant and were consistent across different types of institutions and academic content areas. The most prevalent use of SI is in the natural sciences (46%), followed by social sciences (20%), mathematics (15%), and humanities (7%).

Ogden, Thompson, Russell, and Simons (2003) assessed SI for short- and long-term impact on college academic performance and retention at Georgia State University. Data were compiled for students registered in a political science course supported by SI. Four groups were identified according to their university entry status and SI participation: traditional (regularly admitted) SI participants, conditional (Learning Support Programs or English as a Second Language [ESL] entry status) SI participants, traditional non-SI participants, and conditional non-SI participants. All SI participants volunteered for the program and were thus self-selected. There were no statistically significant differences between SI and non-SI participants in the two comparison groups when preentry attributes were analyzed (i.e., standardized college entrance exam



scores, predicted grade point average). Conditional students participating in SI had significantly higher short- and long-term outcomes compared to conditional non-SI participants. Conditional SI participants reenrolled at a higher rate than did the other three student groups included in this study. Traditional SI participants earned higher final course grades than their non-SI counterparts, though the results were not statistically significant. The ESL students were equally distributed among the four comparison groups and did not serve as a statistically significant factor in outcomes studied. The authors postulated that long-term benefits for SI would be fostered by offering the program throughout the academic course of study of students and not focused so commonly only during the first year of college.

Ashwin (2003) reported about a qualitative study on the impact of SI with an institution in the United Kingdom. More than one-third of the professional literature concerning SI has been published about programs outside the U.S. Ashwin found that attendance at SI sessions was positively and significantly correlated to academic performance. This relationship was found even when prior levels of academic performance were controlled. An unusual finding of the research was that students who attended SI sessions sometimes chose not to employ rigorous study strategies, which resulted in a reduction of the quality of the learning of these students. Qualitative evidence suggested that this change in approach was in response to an increased awareness of the assessment demands of the course and that these students had chosen to devote more effort to other courses that required higher levels of rigor to pass them. It is argued that these results suggest that the outcomes and operation of the SI program were influenced by the context in which it operated.

Congos (2003) is one of the most frequently published authors concerning SI. His latest publication identified recommended policies and practices for SI programs. The document provides a means for conducting a program review with 90 recommended practices. The categories covered by the evaluation tool include: SI leader pre-semester training, SI faculty training, SI leader training during the academic term, SI session observation and feedback, in-class introduction of SI, and end-of-term evaluation.

*Accelerated Learning Groups (ALGs).* Accelerated Learning Groups were developed at the University of

Southern California in Los Angeles in the early 1990s by Sydney Stansbury (2001a; 2001b) and have been adopted at several institutions. They are designed to meet the needs of students who had significant skill or knowledge deficiencies that often inhibited their effective use of other voluntary participation peer cooperative learning programs, such as SI. Stansbury noted that the college students who were least academically prepared were often the ones who never attended, or only attended one or two SI sessions at the beginning of the academic term. The reasons for their noninvolvement included both their severe cognitive deficits as well as motivational issues. This knowledge helped to prompt the need to develop another intervention for these students, which eventually resulted in creation of ALGs (Sydney Stansbury, personal communication, January 15, 2004).

ALGs combine peer-led small group learning activities, assessment, frequent feedback by a learning skills specialist, and development of an individual education plan (IEP) for each student. Students participating in ALGs are concurrently enrolled in a challenging entry-level course while they develop the necessary skills and knowledge prescribed by the IEP. The ALG students are placed into a triad with another student with similar IEP objectives and a peer leader who works intensely with the students under the supervision of a learning skills specialist. Participation in ALGs continues throughout the academic term until the learning skills specialist deems it appropriate for transition into another peer development program or individual tutoring.

Minimum requirements for implementation of ALGs include academic testing of students, staff time of a qualified learning skills specialist, academic monitoring throughout the academic term, employment of well-trained student peer leaders to facilitate the triads, faculty support for the program operating in tandem with their course, and availability of an academic enrichment program, such as SI, to continue modeling cognitive and metacognitive learning strategies with the students after they complete their work within the ALG program.

In a study with students at the University of Southern California, Stansbury (2001a) found that ALGs were especially useful for students considered academically at-risk who were enrolled in an

introductory science course. A pilot study investigated whether at-risk students who participated in an ALG and SI combination demonstrated higher self-efficacy and SI attendance than those who participated in only SI. Results suggested that at-risk students were more likely to participate in 12 or more SI sessions if they attended an ALG and SI combination than if they attended only SI. In addition, the range of final grades was higher for those who attended an ALG and SI combination than for those who attended only SI.

According to ALG's creator, the development of prerequisite skills is essential for the efficacy of SI to serve academically underprepared students who may shun the very academic intervention that would be of most help to them (Stansbury 2001a, 2001b). One of the challenges for SI is that only approximately one-third of students in an average class attend SI sessions. This rate of participation holds nearly the same for all groups within the class, regardless of previous levels of academic achievement as measured by standardized test scores or high school rank or grade point average (Arendale, 1997). Therefore, only one third of the students from the lowest predicted academic preparation level attend SI sessions. It was for this target population that ALGs were created.

*Structured Learning Assistance (SLA)*. Initiated in 1993 at Ferris State University (Michigan), Structured Learning Assistance workshops assist students in developing the background needed to connect to the course content and to develop and apply the learning strategies most appropriate to the content area. SLA has been recognized through several national awards and is currently supported by a three-year U.S. Department of Education grant from the Fund for the Improvement of Postsecondary Education (FIPSE). Results indicated that SLA can significantly improve student pass rates, including rates for at-risk students. Other institutions have attended training workshops hosted by Ferris State University to enable them to implement SLA. The current FIPSE grant supports four other institutions in successfully implementing the SLA model (Wolgamott, 2004).

SLA provides both an academic and an affective support system. SLA targets courses that are considered high-risk for failure, academically rigorous gateway courses for academic majors, or historically difficult upper- division courses. The SLA workshops are

formally scheduled four hours weekly in the student schedule similar to an accompanying science lab. Attendance at the workshop is required of all students the first week of the course or until the first test, quiz, or other assessment is given in the class. Following this first course assessment, attendance is required only for students whose current grade in the course falls below a C. Other students may voluntarily continue to attend the SLA sessions. SLA was created, among other purposes, to address the problem of less academically-prepared students who were often not attending either SI or individual tutoring sessions (Wolgamott, 2004).

SLA class professors receive regular, ongoing information about student progress, student concerns, and ways of better connecting with students. SLA sessions provide explicit instruction in learning strategies. Research studies suggest that SLA students earn higher final course grades than nonparticipants in control groups (Doyle, 1999; Kowalczyk, 2003). A faculty development component is also part of SLA, which supports higher academic achievement for students. Informal classroom assessment information is provided to participating faculty members to assist them in making modifications to classroom activities and prompt review of difficult concepts (Doyle).

Two research studies have been published externally about SLA. Doyle and Kowalczyk (1999) conducted analyses of data collected within the SLA program at Ferris State University. Data suggested the following outcomes for the SLA program: (a) higher rates of students earning C- or better in the course, (b) higher persistence rates at the institution, and (c) 73% of students attributed SLA as significant to their academic achievement.

In another study at Ferris State University, Doyle and Hooper (1997) investigated SLA during a 3-year study. Results suggested that SLA can significantly improve student pass rates, even for students considered academically at-risk. In nearly 85% of the 42 courses offered with SLA support, the SLA students had higher pass rates than those of all other Ferris State students taking the same courses. This improvement was especially marked in the mathematics courses, where the average pass rate increased anywhere from 24% to 45%.

## *Embedded Peer Cooperative Learning Programs Within the Course*

*Emerging Scholars Program (ESP)*. Developed at the University of California, Berkeley in the early 1980s, the Emerging Scholars Program is also known as the Calculus Workshop Program, the Mathematics Workshop Program, and the Treisman model after its creator, Philip Uri Treisman (1986). The ESP program has been adopted and adapted by more than 100 institutions across the U.S. (Born, 2001). ESP was based on qualitative research by Treisman, who investigated the difference in academic success of students of different ethnic and cultural groups. The academic success rate for African American students in math, science, and engineering graduate programs was very low in comparison to Asian students. After an extensive ethnographic study of Asian students at UC-Berkeley, Treisman designed a program that created a system based on the informal student-driven sessions created by the Asian students in challenging calculus courses. The resulting program not only was based on sound cognitive learning strategies, but was also attentive to the affective domain of learning. After successful use with students of color at many institutions, implementors of the program have found positive results for many student demographic categories (Fullilove & Treisman, 1990; Moreno, Muller, Asera, Wyatt, & Epperson, 1999).

Most ESP programs shared the following elements: (a) build a cohort community of first-year students of color that is academically oriented and a source of peer support, (b) provide the cohort with an extensive orientation to the institution and with ongoing academic advising, (c) advocate the interests of the cohort, (d) monitor their academic progress and adjustment to the environment, (e) provide the cohort with ongoing adjunct instructional sessions that promote development of cognitive and metacognitive learning strategies needed for independent learning, and (f) link high school-level and undergraduate-level affirmative action efforts (Treisman, 1986). During most ESP implementations, students commit themselves to attend two additional lab sessions weekly, each lasting two hours each. At some institutions students are required to attend the sessions based on preentry test scores, and at other institutions students are encouraged to make a commitment through creation of a perception that ESP is an honors program and that it is a privilege to

participate (Leopard, 2001, Mills, 1999). Following is a summary of several research studies that have been conducted concerning ESP.

Born (2001) conducted a 2-year, quasi-experiment at Northwestern University to evaluate the effect of ESP on performance of historically underrepresented students (e.g., African American, Hispanic) and traditional (e.g., Caucasian, Asian) undergraduate biology students in a three-course series and to investigate motivational explanations for performance differences. Traditional students randomly assigned to the ESP workshops ( $n = 61$ ) performed between one half and one standard deviation better than those assigned to the control group ( $n = 60$ ;  $p < .05$ ) in each quarter without spending more time studying. During the first quarter, ESP historically underrepresented students ( $n = 25$ ) showed a pattern of increasing exam performance in comparison to nonparticipant students of similar ethnic background ( $n = 21$ ), who showed a decreasing pattern ( $p < .05$ ). Although gender differences in biology performance were studied, none were detected between those who participated in ESP and those who did not.

Fullilove and Treisman (1990) conducted an extensive study of the ESP at the University of California, Berkeley, between 1978 and 1984 with African American mathematics students. To provide comparison data, a baseline of student performance was established during the period of 1973 to 1977 before the ESP program was provided to students. The percentage of nonparticipants in ESP that earned grades of D or below ranged from 33% to 41%, depending upon the year. The ESP participants earned similar grades at a much lower rate, ranging between 3% and 7% in comparison over the time period. The percentage of nonparticipants earning grades of B- or higher ranged from 10% to 28%. The ESP participants earned much higher grades in comparison, with the percentage at B- or above ranging between 39% and 61%. The persistence and graduation rates favored the ESP participants at 65% versus 41% for the nonparticipants. The study took into account preentry attributes such as SAT scores on the verbal and mathematics subtests.

Leopard (2001) investigated affective, metacognitive, and conceptual effects of an Emerging Scholars Program on elementary teacher preparation. The study involved an elementary mathematics content



course that was constructivist in nature and emphasized the tenets of the National Council of Teachers of Mathematics Standards. Qualitative measures included in the study were student interviews, mathematical autobiographies, and classroom observations. Quantitative measures consisted of surveys on metacognition and mathematics anxiety and concept maps. Data concerning affective, metacognitive, and conceptual changes was analyzed both qualitatively and quantitatively. Results indicated an increase in metacognitive skills and a decrease in mathematics anxiety. The potential effect of ESP participation upon conceptual understanding was inconclusive. However, a significant increase in the preservice teachers' level of self-confidence in teaching was noted. The ESP appeared to have a positive effect on preservice elementary teachers when considering affective and metacognitive attributes related to mathematics, but appeared to have had a neutral effect on the reconceptualization of mathematical ideas.

Mills (1999) reported an in-depth study of ESP in chemistry and physics courses at the California State Polytechnic University, Pomona. Data for the first longitudinal component of this study were obtained by tracking three groups of students during spring 1998: (a) ESP participants from historically underrepresented groups (e.g., Latino, African American, and Native American workshop students); (b) a random sample of non-ESP participants who were from the same historically underrepresented groups; and (c) a random sample of non-targeted students (e.g., Anglo and Asian) enrolled in the same classes. Data for the second component of this study, an analysis of qualitative data, were obtained by administering questionnaires, conducting interviews, and observing science students. Even after taking into account verbal and mathematics SAT scores, ESP participation was a significant predictor of first-quarter course grade for historically underrepresented students in both chemistry and physics.

*Video-based Supplemental Instruction (VSI).* SI was developed at the University of Missouri, Kansas City, in the late 1980s and has been implemented by dozens of institutions in the U.S. and abroad. Video-based Supplemental Instruction is an interactive information processing and delivery system that helps academically at-risk students master rigorous course content as they concurrently develop and refine reasoning and learning skills. Rather than requiring prerequisite enrollment

in a traditional developmental course, VSI is a learning system that mainstreams the best practices of developmental education into historically-difficult core curriculum courses. Research suggests the efficacy of VSI for improving academic achievement for students of diverse levels, from elementary school children studying mathematics through professional school for future doctors studying to pass the first step of their medical license examination boards. VSI is presented as a holistic alternative to traditional approaches of developmental education (Martin, Arendale, & Blanc, 1997).

VSI differs from SI in several respects. With VSI, the students enroll in a designated core curriculum course. The course professor has previously recorded all didactic presentations on videotape for use with underprepared students as well as other students who opt for this highly interactive way of learning. Instead of attending the professor's regular lecture class, students enroll in the video section of the professor's course. Students in both sections, live and videotaped, are held to the same performance standards. Specially designed facilitator and student manuals support the video sections (Martin & Blanc, 2001). Integrated within these manuals are sections that require the students to practice use of appropriate study and learning strategies with the course content material. The VSI section of the course functions much like a distance learning telecourse.

VSI participants, led by a trained facilitator, start and stop the videotaped presentation at predetermined times as well as whenever they have a question or want clarification. Professors design the video presentations to include periodic small group assignments to insure mastery of one concept before the next is introduced. Students complete these tasks under the supervision and with the guidance of the facilitator. When the taped lecture resumes, the professor models how he or she thinks about the assigned tasks. In this way, the students have time to construct and verify their understanding as well as compare their own thinking to that of the expert (Martin & Blanc, 2001).

There are several published research studies concerning VSI. Hurley (2000) investigated several questions of the VSI program at the University of Missouri-Kansas City: (a) final grades earned by students in VSI as compared with students enrolled in a lecture-format class with the same professor; and (b)

potential changes in self-efficacy, self-confidence and mastery of learning strategies of VSI participants. The major conclusions from the study were the following: (a) the VSI participants received a statistically significant higher percentage of A and B grades than a comparable group of non-VSI students in the same history class over 14 semesters, and (b) the VSI participants received a statistically significant lower rate D and F final course grades than the non-VSI participants. Interviews with VSI participants suggested that VSI was a significant factor in the acquisition of a variety of strategies that provided them with the academic tools to be successful on their history exams in that class. In addition, the VSI participants indicated that they developed a greater sense of self-efficacy in the class and greater personal confidence.

Research by Koch and Snyders (1997) is representative of the studies conducted by VSI programs outside the U.S. The researchers investigated the effect of VSI on the mathematics performance of students whose matriculation marks did not enable them to be directly admitted to the Science Faculty at the University Port Elizabeth (UPE), South Africa. These students were enrolled in Ethembeni Community College in Port Elizabeth, which serves as a preparation area before admission to UPE. Fifteen students who enrolled in VSI math were matched with 14 students enrolled in a similar math course that required attendance at Supplemental Instruction (SI) sessions. Research suggests that VSI was a more useful instructional delivery system for students with a minimum level of preknowledge in mathematics. In addition, the researchers suggested the usefulness of VSI in distance learning venues where experienced and trained faculty members are unavailable to deliver live instruction.

*Peer-Led Team Learning (PLTL).* Peer-Led Team Learning is an innovative model in science education. PLTL was originally developed at the City University of New York (CUNY) in the mid 1990s. Support through a grant from the National Science Foundation has assisted in adoption of this model by more than 100 institutions. A Web site maintained by the national PLTL office disseminates information and research studies concerning PLTL (Dreyfus, 2004).

Student leaders guide the activities of small groups of students in weekly PLTL meetings. These meetings are included as part of the course requirements. The students work through challenging problems that are

designed to be solved cooperatively. The student leaders receive extensive training before the beginning of the academic term in a wide variety of areas including how to foster student engagement with the content material and with each other. According to the program's developers, the PLTL methodology offers a number of educational opportunities: (a) the supportive format encourages questions and discussions that lead to greater conceptual understanding; (b) students learn to work in teams and to communicate more effectively which are valuable skills needed for further success in postsecondary education as well as when they enter the world of work; (c) use of standardized adjunct print curriculum materials and workbooks help to ensure higher quality learning that is more often uniformly experienced by all students at PLTL-implementing institutions; and (d) peer leaders learn teaching and group management skills (Cracolice & Deming, 2001).

A difference between the approaches of PLTL and ESP relates to curriculum development. While in ESP each course supported by the program develops its own curriculum materials, the national office for PLTL has published supplemental textbooks and workbooks that can be added to the course delivery and also serve as models for development of local curricula. In addition, PLTL offers national conferences and training workshops to support institutions with implementing the program. This latter approach allows for more efficient and effective adoption of the PLTL program and increases the quality of sessions that are facilitated by student peer leaders (Cracolice & Deming, 2001).

The following are guiding principles of PLTL: (a) the program is integral to the course through required attendance at two hours of workshop time weekly, (b) peer leaders are trained in group leadership and course content, (c) activities and materials are challenging yet accessible, (d) faculty are deeply involved in the program, (e) physical space and environments are conducive to discussion and learning, and (f) the program has strong support from the institution (Gosser, Cracolice, Kampmeier, Roth, Strozak, & Varma-Nelson, 2000; Gosser & Roth, 1998).

In addition to numerous studies provided through the national PLTL Web site, independent researchers are conducting detailed studies at their home institutions. Tien, Roth, and Kampmeier (2002) reported their study of PLTL in an undergraduate organic chemistry course. Quantitative and qualitative

data were collected. PLTL participants (i.e., treatment group) were compared with students who participated in recitation sessions (control group). PLTL participants earned higher final course grades and had higher persistence rates. Analysis of interviews with PLTL participants suggested that the program helped them to learn more course material, and that they were more socially engaged, intellectually stimulated, and found the experience to be a productive use of time.

## Selecting the Cooperative Learning Model for Institutional Needs

To display the relationship between the six identified peer cooperative learning programs and learning assistance programs in general, it would be helpful to compare them with Keimig's (1983) Hierarchy of Learning Improvement Programs:

In the Hierarchy of Learning Improvement Programs, four basic program types are described and ranked, differentiated by the extent by which they are comprehensive in response to the various needs of students and institutionalized into the academic mainstream. Level I: Isolated courses in remedial skills. Level II: Learning assistance to individual students. Level III: Provides course-related supplementary learning activities outside the class for some

objectives. Level IV: Comprehensive learning system in the course. (p. 21)

Using Keimig's hierarchy it is possible to arrange the six peer cooperative programs as illustrated in Figure 2. According to Keimig, the highest level of student outcomes occurs when a comprehensive learning system is integrated throughout the course learning experience. This requires a transformative experience by the institution due to: (a) heavy involvement of the course professor with curriculum development; (b) training, monitoring, and supervision of peer group facilitators; (c) alignment of educational objectives among all course components; (d) changes in institutional and course policies and expectations; (e) release time for professors to complete essential tasks; and (f) stable, long-term institutional funding because outside grants are difficult to obtain or maintain. ESP, PLTL, and VSI fit into this fourth category level. Although these programs have a higher likelihood of improved student outcomes, they are also the most demanding of institutional resources and changes in the campus environment.

The next level of programs, according to Keimig, are those that are adjunct to the course and provide support for it through either voluntary or required participation. ALGs, SLA, and SI are placed into this group. The expectancy for results, based on Keimig's model, is not as high as for the level four comprehensive

Figure 2. Placing Peer Cooperative Learning Programs Within Keimig's Hierarchy of Learning Improvement Programs.

Levels of Integration Within the Course	Peer Cooperative Learning Programs	Likelihood of Improved Student Outcomes
Level Four: Comprehensive learning system within the course	ESP, PLTL, and VSI	High
Level Three: Supplementary learning activities adjunct to the course	ALG, SLA, and SI	Above Average
Level Two: Learning assistance to individual students, i.e., tutoring, outside of the course		Below Average
Level One: Isolated separate courses in remedial skills		Low

programs as described in the previous paragraph. But ALGs, SLA, and SI are predicted to yield higher student outcomes than either individual assistance to students such as that provided through tutoring or enrollment in remedial courses. This third category is less expensive and less labor intensive to implement, but may yield lower desired student outcomes.

Higher levels of institutionalization of peer learning programs require high levels of funding and support from administration and faculty members. This investment may pay high dividends. The future political and economic environment may be more supportive for these types of programs for supporting higher student persistence rates in comparison with traditional remedial or developmental education courses, which are under considerable pressure for curtailment as described earlier in this chapter. It is recommended that before adoption of any of the six programs, a careful review of the published literature be undertaken as well as personal communication with those successfully operating the programs.

Some of the programs, such as PLTL and SI, offer national training workshops to enable others to implement the programs. On-site observations can probably be negotiated with any of the six programs. The investment in such telephone and on-site observations will help to reveal the essential elements needed for successful implementation of the specific practice. Often these essential details are not revealed in the published literature, which tends to be more focused on statistical studies and not on the detailed implementation protocols. Based on personal experience as a former national training director for one of the six programs, I strongly recommend careful planning before attempting to implement the programs. Although the educational outcomes described in the published literature are replicable, achieving these outcomes generally requires careful implementation and constant monitoring to assure continued quality.

### Further Research Issues Regarding Peer Cooperative Learning

One of the most perplexing issues facing peer cooperative learning groups is dealing with student motivation and goal orientation. Sometimes the students who could most benefit from the positive effects of peer learning are the ones least likely to participate due to fear of exposing their academic weaknesses to others

or even to themselves. Most of these six programs have dealt with the issue through mandatory attendance at sessions. Although brute force does compel attendance, it does not necessarily follow that students willingly adopt the new academic behaviors and implement them in other courses when not under the dictates of program requirements. The complexity of student motivation is being carefully studied among elementary and secondary education student populations. However, this important construct is often ignored in the study of postsecondary education in general, and research regarding the provision of learning assistance at the college level is overlooked in particular.

Creating peer cooperative learning programs that provide both structure and an environment that encourages students to modify their motivations for learning will require more work by program designers. Too often students have been expected to adopt the expectations and learning conditions of the institution without direct instruction. This literature supports the notion that it is necessary for institutions to implement programs that are more attentive to individual differences among students. Much work has yet to be done.

### Additional Resources

By its very nature, this chapter will be dated as soon as it is printed. Further information on these six postsecondary peer cooperative learning programs is available through the following Web site: <http://www.tc.umn.edu/~arend011/>. In addition to the interactive database, a print version of the annotated bibliography is available in the Acrobat PDF format for users to read online or to print on their computer. This print document as well as the on-line resource and instruction for its use are available at <http://www.tc.umn.edu/~arend011/Peerbib03.pdf>.

### References

Arendale, D. (1997). Supplemental Instruction: Review of research concerning the effectiveness of SI from The University of Missouri-Kansas City and other institutions across the United States. In *Proceedings of the 17<sup>th</sup> and 18<sup>th</sup> Annual Institutes for Learning Assistance Professionals 1966 and 1997* (pp. 1-25). Tucson, AZ: University Learning Center, University of Arizona.





- Gabelnick, F., MacGregor, J., Matthews, R. S., & Smith, B. L. (1990). *Learning communities: Creating connections among students, faculty, and disciplines*. San Francisco: Jossey-Bass.
- Gosser, D. K., Cracolice, M. S., Kampmeier, J. A., Roth, V., Strozak, V. S., & Varma-Nelson, P. (2000). *Peer-Led Team Learning: A guidebook*. Upper Saddle River, NJ: Prentice Hall.
- Gosser, D. K., & Roth, V. (1998). The workshop chemistry project: Peer-Led Team Learning. *Journal of Chemical Education*, 75(2), 185-187.
- Hurley, M. A. (2000). Video-based Supplemental Instruction (VSI): An interactive delivery system that facilitates student learning [Dissertation, University of Missouri-Kansas City, 1999]. *Dissertation Abstracts International*, 61(04), 1317.
- Johnson, D. W., Johnson, R. T., Holubec, E. J., & Roy, P. (1984). *Circles of learning: Cooperation in the classroom*. Washington, DC: Association for Supervision and Curriculum Development.
- Keimig, R. T. (1983). *Raising academic standards: A guide to learning improvement*. ASHE-ERIC Higher Education Report No. 4. Washington, DC: Association for the Study of Higher Education.
- Koch, E., & Snyders, M. (1997). *The effect of Video Supplemental Instruction on the academic performance in mathematics of disadvantaged students*. Unpublished manuscript, University of Port Elizabeth, South Africa. Available: Center for Supplemental Instruction, University of Missouri-Kansas City, 5014 Rockhill Road, SASS #210, Kansas City, MO 64110.
- Kowalczyk, J. (2003). *Executive summary: Winter 2003 SLA program*. Unpublished manuscript, Ferris State University. Retrieved from June 22, 2004, from <http://www.ferris.edu/htmls/colleges/university/cool/outcomes/SLAsummary/>
- Leopard, B. B. (2001). Affective, metacognitive, and conceptual effects of an Emerging Scholars program on elementary teacher preparation: An application of the Treisman workshop model [Dissertation, The University of Toledo, 2000]. *Dissertation Abstracts International*, 61(10), 3958.
- Lipsky, S. A. (Ed.). (2004). *Internet homepage for the NADE SI Special Professional Interest Network* [On-line]. Retrieved June 22, 2004, from <http://www.iup.edu/lec/AcadAssist/SI/SI%20Help.htm>
- Martin, D. C., & Arendale, D. (Eds.). (1994). *Supplemental Instruction: Increasing achievement and retention* (New Directions for Teaching and Learning No. 60). San Francisco: Jossey-Bass.
- Martin, D. C., Arendale, D., & Blanc, R. A. (1997). *Mainstreaming of developmental education Supplemental Instruction and Video-based Supplemental Instruction*. Unpublished manuscript, The University of Missouri-Kansas City. Retrieved June 22, 2004, from <http://www.umkc.edu/cad/si/sidocs/sivsi97.htm>
- Martin, D. C., & Blanc, R. (2001). Video-based Supplemental Instruction (VSI). *Journal of Developmental Education*, 24(3), 12-14, 16, 18, 45.
- Mills, S. R. (1999). Academic excellence workshops in chemistry and physics (Uri Treisman) [Dissertation, The Claremont Graduate University, 1999]. *Dissertation Abstracts International*, 60(06), 1968.
- Moreno, S. E., Muller, C., Asera, R., Wyatt, L., & Epperson, J. (1999). Supporting minority mathematics achievement: The Emerging Scholars Program at The University of Texas at Austin. *Journal of Women and Minorities in Science and Engineering*, 5(1), 53-66.
- Ogden, P., Thompson, D., Russell, A., & Simons, C. (2003). Supplemental Instruction: Short- and long-term impact. *Journal of Developmental Education*, 26(3), 2-4, 6, 8.
- Painter, S. (Ed.). (2004). *Internet homepage for the Center for Supplemental Instruction* [On-line]. Retrieved June 22, 2004, from <http://www.umkc.edu/cad/si/>
- Parsad, B., & Lewis, L. (2003). *Remedial education at degree-granting postsecondary institutions in Fall 2000: Statistical analysis report*. Washington, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved June 22, 2004, from <http://nces.ed.gov/pubs2004/2004010.pdf>



- Stansbury, S. L. (2001a). Accelerated Learning Groups enhance Supplemental Instruction for at-risk students. *Journal of Developmental Education*, 24(3), 20-22, 24, 26, 28, 40.
- Stansbury, S. L. (2001b). *How to turn Supplemental Instruction nonparticipants into participants*. Unpublished manuscript, University of Missouri-Kansas City. Available from the author at Sydbury@Yahoo.com
- Tien, L. T., Roth, V., & Kampmeier, J. A. (2002). Implementation of a Peer-Led Team Learning instructional approach in an undergraduate organic chemistry course. *Journal of Research in Scientific Teaching*, 39, 601-632. Retrieved June 22, 2004, from <http://www.chem.rochester.edu/~chem203>
- Treisman, P. U. (1986). A study of the mathematics performance of Black students at the University of California, Berkeley [Dissertation, University of California, Berkeley, 1985]. *Dissertation Abstracts International*, 47(05), 1641.
- Wolgamott, L. (Ed). (2004). *Internet homepage for Structured Learning Assistance*. [On-line]. Retrieved June 22, 2004, from <http://www.ferris.edu/htmls/academics/sla/>

